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WOOD'S MEDICAL AND SURGICAL MONOGRAPHS



NEURALGIA; ITS ETIOLOGY, DIAGNOSIS, AND
TREATMENT

BY W. R. GOWERS, M.D., F.R.C.S.

THE PROGNOSIS OF DISEASES OF THE HEART

BY PROF. E. LEYDEN, BERLIN.

THE SPUTUM. A CONTRIBUTION TO CLINICAL
DIAGNOSIS AND PRACTICAL EXAMINATION
FOR TUBERCLE BACILLI

BY PETER KAATZER, M.D.

HYPNOTISM. ITS SIGNIFICANCE AND MAN-
AGEMENT BRIEFLY PRESENTED

BY DR. AUGUST FOREL.

THE FORMS OF NASAL OBSTRUCTION, IN
RELATION TO THROAT AND EAR DISEASES

BY GREVILLE MACDONALD, M.D.

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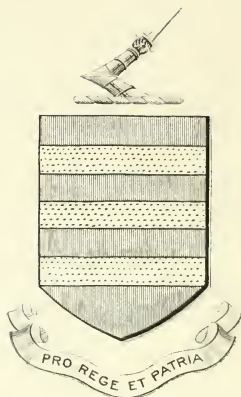
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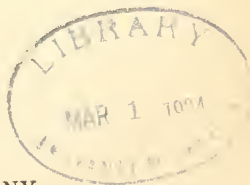
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NEURALGIA;

ITS

Etiology, Diagnosis, and Treatment.

BY

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NEURALGIA.

THE word "neuralgia" means simply "nerve pain"; such pain may be due to actual disease of a nerve trunk, by which its fibres are irritated, or it may occur without any organic lesion. It is true that the absence of such morbid change cannot often be proved by actual microscopical examination, but the transient character of the pain, and its migration from one part to another, frequently afford strong confirmation of the opinion that, in a large number of the cases of local nerve pain, the symptoms are not due to actual organic change. Two classes of neuralgias have been distinguished—"symptomatic," in which the pain is a symptom of organic disease of the nerves, and "idiopathic," in which the malady, in the first instance, at least, consists only in functional disturbance. Both of these forms have been called "neuralgia" by some writers. By others, however, the term is restricted to the idiopathic class, and this seems to be the only logical course. It is manifestly unreasonable to describe inflammation of nerves as "neuralgia" when it causes much pain and few other symptoms, and as "neuritis" when other symptoms predominate over pain. But the distinction of the two forms of nerve pain is often very difficult in practice. In some forms described as neuralgia, the pain has certainly been generally the result of neuritis. This is the case, for instance, with sciatica, which is generally an inflammation of the nerve. Yet, not only has the common form of sciatica been described as a neuralgia, but its symptoms have been allowed to influence the description of neuralgia in general. In ascertaining the clinical history of neuralgia, it is therefore of great importance that only cases should be used in which a primary

organic lesion of the nerve trunk or centres can be excluded with reasonable confidence. This limitation does not, however, exclude organic lesions of nerve endings. In many cases some structural irritation of the termination of nerves sets up a neuralgia of wide range, and out of all proportion to its cause. Such cases are classed among neuralgias, and are very different from those in which a primary lesion of a nerve trunk causes local and limited pain.

The subject of neuralgia is a very large one, so numerous are the forms of the disease, and so varied its characters. It will be most instructive to consider the general causes and symptoms of the affection, and also its general pathology, before describing its special varieties.

Etiology.—Neuralgia is essentially a disease of adult life. It is rare before puberty, and is not common in extreme old age, although, when the disease does commence late in life, it is often very severe and intractable. Most cases commence between twenty and sixty years. Children enjoy an almost complete immunity from true neuralgia, although very liable to certain headaches which do not come under this category. Women are more prone to neuralgia than men, but the degree of their liability has often been over-estimated, and the excess of females among the sufferers disappears in the second half of life. Moreover, the relative liability of the sexes is not the same in the several varieties. The tendency to neuralgia is often hereditary, although not so frequently as in the cases of migraine. Anstie found evidence of heredity in only one-quarter of his cases. Sometimes the inherited tendency is not special but general, indicated by the occurrence in ancestors or collaterals of epilepsy, insanity, and other neuroses.

The subjects of neuralgia often present a peculiar temperament. They are what is popularly called “nervous”—excitable, often irritable, anxious, worrying over the trifling ills of life, sleeping badly, and are often extremely liable to headaches not distinctly neuralgic in character. In many patients the neuralgic tendency is deeply rooted; they suffer from neuralgia first in one situation and then in another during the course of years. The disease is more frequent in those of weakly constitution than in the robust, but the latter do not enjoy complete immunity. Among the constitutional relations of neuralgia, those to rheumatism and gout are especially im-

portant. The connection with rheumatism is often conspicuous, and is seen in several aspects. Persons who are liable to rheumatism of the fibrous tissues sometimes suffer from pains which have both rheumatic and neuralgic characters—not specially related to the nerves in situation, and yet paroxysmal and unconnected with movement. Such pains are especially frequent in the limbs and back. Women who suffer from rheumatoid arthritis are often also liable to true neuralgias of great severity. A young lady, for instance, suffered for several months from severe paroxysms of pain in one shoulder and the dorsal spine, apparently neuralgic; these ceased, and she was immediately attacked by subacute rheumatoid arthritis. Lastly, both rheumatic affections and neuralgia are certainly sometimes due to gout, and probably, not infrequently, to inherited gout.

Among the exciting causes of neuralgia, among those that are remote, impairment of general health takes the first place. The affection may be excited by any kind of debilitating influence; overwork of mind or body, over-lactation, prolonged fatigue, and anæmia of every degree and causation, are frequently met with as its immediate antecedents. Certain forms of sensory fatigue, as over-stimulation of the eyes, sometimes seem to have a special influence. Severe emotion, or its physical analogue, mechanical concussion, are also occasional exciting causes; the former is often combined with the latter. As examples of the influence of emotion two cases may be mentioned, one of slight, the other of severe, neuralgia, thus induced. A lady was intensely distressed after parting with her husband, who was going to America. She felt on the point of bursting into tears, and as if the tears would give her relief. Her sister said, "Do not cry; you shall not cry." By an effort she succeeded in restraining her tears, but was immediately conscious of a sense of intense pressure above the eyebrows, and a few days later severe supra-orbital neuralgia came on upon the left side, and lasted for several weeks. A girl of eighteen was much startled and alarmed by the unexpected discharge of a gun close beside her. The same evening facial neuralgic pain came on, and continued for five years in most violent paroxysms, sometimes on one side, sometimes on the other. In this connection it may be noted that the fifth nerve is especially related to emotion, both by influencing the

secretion of tears and also as the sensory nerve of the chief region of emotional display—the face.

No single actual excitant of neuralgia is so frequent as exposure to cold, sometimes general, sometimes local and affecting the part in which the neuralgia is felt. Valleix found a history of exposure to cold in one-third of his cases. Cold may not only produce neuralgia, it may also excite paroxysms of pain when the neuralgia is due to some other cause. Another frequent cause is the irritation of nerves, especially near their peripheral distribution. The pain often extends far beyond the area supplied by the irritated nerve. A common example is the widespread pain that may result from the irritation of a carious tooth; the pain may extend into other divisions of the fifth nerve, and even into the region of the cervical plexus. Moreover, the pain may be felt only or chiefly in some other region than that in which it is produced. Thus, I have known severe neuralgia confined to the second division of the fifth to be due to a carious tooth in the lower jaw, and cease entirely when this was extracted. Traumatic lesions of nerves constitute another cause, relatively infrequent, but very important on account of the extreme obstinacy of the pain they cause.

Toxic influences often give rise to neuralgia. The most frequent are alcoholism, lead poisoning and the presence of an excess of sugar in the blood. The influence of some of these causes in producing neuralgia is, however, probably less than has been assumed, because we now know that the nerve pains that are caused by them are sometimes the expression of actual neuritis. This is especially the case with the pains of alcoholism. Nevertheless, when all cases are excluded in which there is reason to believe that neuritis exists, there remain many others, which, from their character, must be regarded as neuralgic. It is intelligible that a condition which has such an influence as to produce actual inflammation of nerves should often irritate them so as to cause neuralgia. This statement is also applicable to gout, the influence of which has been already mentioned. Both neuritis and neuralgia may unquestionably result from acquired and inherited gout. Malaria is a powerful cause of neuralgia, but its influence is seldom seen in this country.

Symptoms Generally.—The great symptoms of neuralgia is pain, spontaneous, paroxysmal, and felt in certain regions

of nerve distribution. It is usually unilateral; when bilateral it is almost always symmetrical in distribution. Usually the pain is constant in seat for a time, it may be for many years. In other cases it changes, now in one part, now in another. Thus, a girl aged fifteen had suffered for two years from paroxysms of intense pain in various parts—arms, legs, back, different parts of the head—and occasionally universal.

The pain is never constant in degree; there are paroxysms, with intervals of complete freedom, or there is a slight, continuous pain, with intense exacerbations. Continuous pain may be merely a dull ache, but it is generally acute and sharp during the paroxysms, and is described as “darting,” “stabbing,” “boring,” “burning,” etc.; often the sufferer can find no words to express its exact character. The sharp pain generally has a darting character. A series of sudden sharp pains occur every few minutes; the series of successive pains constitute a paroxysm, and a series of paroxysms an attack. The intervals between the attacks present extreme variation, and are sometimes remarkably long in proportion to the severity of the pain. Thus, one patient will have attacks daily during several years, while in another (as in an actual instance) intervals of many months separate groups of attacks of most intense pain, each group lasting only a few days. In such paroxysms it is usual for the pains to commence suddenly, but they are rarely as severe at first as they subsequently become. Sometimes a peculiar sensation, such as throbbing, heralds each attack of pain. The attacks gradually increase in intensity, and in each attack the separate paroxysms may present a characteristic augmentation and decrease.

The pain is rarely referred to the skin; usually it is more deeply seated, and often corresponds to the position of a nerve trunk and branches. The throbs of pain sometimes, but seldom, coincide with the arterial pulsations. There is often a darting movement of the pain, usually toward the periphery—centrifugal—less commonly from the periphery—centripetal; still less commonly the pain darts alternately in both directions. Sometimes it seems to be localized in a single point, and then has usually a boring character. When most intense the darting pains seem to radiate to other nerve regions adjacent to that in which it is chiefly felt.

The duration of each attack varies according to the num-

ber of paroxysms and their length. Rarely there is a single momentary pain, and it is over for the time. Commonly an attack lasts several minutes, sometimes for hours. When there is freedom from pain, in the intervals there is sometimes a peculiar sensation in the part, not amounting to actual pain. The intervals vary in duration from a few hours to several months. Often an approximate periodicity exists; exact periodicity is met with in malarial cases, in which it may be singularly precise, the pain commencing at the same hour each day. The intervals in such cases rarely exceed four days. Now and then the periodicity is exact in cases that are not malarial. The pain may be worse at the catamenial periods, and I have once known a fifth-nerve neuralgia to occur only at those times. When there is continuous pain in the intervals between the paroxysms, it is moderate in degree, supportable in itself, but often most trying to the patient, as it prevents rest.

The paroxysms and attacks are often induced by certain influences, external or internal, such as by exposure to cold, sometimes by warmth, by movement, posture, or emotion. In some cases there is remarkable sensitiveness to atmospheric influences. When the paroxysms occur at regular intervals an influence that will induce the pain when it is "due," may be powerless immediately after an attack. During a paroxysm, the influences that will bring it on usually intensify the pain. Movement is especially influential in the neuralgias of the fifth nerve; the slightest motion of the jaws may bring on the pain. A touch on the skin may have the same effect; nevertheless, in many cases, although slight pressure increases the pain, firm pressure gives distinct relief, and even when mere contact with the skin causes an exacerbation, rough rubbing may distinctly relieve the suffering. This difference, however, is not always to be observed. Occasionally alcohol, even in small quantities, invariably intensifies or induces the pain; in other cases it gives relief. (Very curious facts are sometimes met with in regard to the induction of the pain. Thus, in one patient, intense fronto-occipital neuralgic pain was excited by every act of defecation. This action, in some cases, has a very peculiar influence on the nervous system, and so also has micturition, as the familiar shiver shows. I have known micturition to be frequently attended with a moment's loss of consciousness.)

This increased sensitiveness of the skin is a very common accompaniment of the pain. It may involve all forms of sensation, although thermic impressions much less commonly occasion pain than does a touch. Sometimes the tactile impression seems to be felt as pain; more often it excites an increase in the true neuralgic pain. The hyperæsthesia, or hyperalgesia, is usually limited to the region in which the spontaneous pain is felt. When this pain follows the course of a nerve, it is commonly most intense at certain spots, and at these places pressure may cause a special increase in the suffering. In the intervals between the paroxysms, these spots may remain tender, and pressure upon them may induce a paroxysm. They are not usually present until the disease has lasted for some time. In recent cases, and when the attack occurs only at long intervals, although there is no persistent tenderness, the pain may be increased during the paroxysm by pressure on certain places. The tender points were first studied by Valleix, and hence are often called after him. They are present in about half the cases; when absent there is sometimes diffuse, ill-defined tenderness in certain areas. When the tender points are well marked and definite, they are tolerably uniform in their position, and for the most part correspond either to the place at which a nerve trunk emerges from a bony canal, passes over a hard structure, or passes through a fascia to become superficial, or to the point of division of a nerve trunk, or to an anastomosis of two nerve trunks. Their exact situation will be mentioned in the description of the several varieties of neuralgia.

There is occasionally tenderness of the vertebral spine corresponding to the origin of the painful nerve, the *point apophysaire* of Trousseau. It is probable, as Anstie pointed out, that the relation of this to neuralgia has been exaggerated. Tenderness of certain vertebral spines is common apart from neuralgia, and there is not always a close correspondence between the position of the spinal tenderness and the seat of the neuralgia. In trigeminal neuralgia, for instance, there may be tenderness of the cervical spines. It is said (by Brenner) that the spots of spinal tenderness, when undiscoverable by pressure, may sometimes be detected by a weak voltaic current, causing, in those positions, distinct pain.

Other sensory disturbances are occasionally observed in

neuralgia. It is said that the onset of the pain is sometimes preceded by numbness, tingling, etc., in the affected area, but it is doubtful whether this is true of simple neuralgia. Occasionally the attack of pain is followed by transient anæsthesia. Persistent diminution of sensibility is only met with in cases of "symptomatic neuralgia," in which there are structural changes in the nerves. Increased sensitiveness to pain (hyperalgesia) in the whole area of the neuralgia is not uncommon. Vomiting is rarely associated with simple neuralgia, although in migraine, the pain which terminates in vomiting is often of a neuralgic character, either localized in the temporal branch of the fifth, or more extensively distributed over the cranium. Now and then paroxysms of true neuralgia end in vomiting, an interesting link of association with migraine. I have met with this in two cases of neuralgia; one, bilateral, in the anterior branches of the cervical plexus, and the other in the two upper divisions of one fifth nerve. Severe attacks in women often cause hysterical symptoms as the pain is subsiding.

Muscular spasm may be excited by the acute paroxysms of pain, evidently in a reflex manner. It is usually confined to the motor nerve related to that which is the seat of the pain, but sometimes spreads to adjacent areas, very rarely passing into a general convulsion. In a case of cranio-spinal neuralgia, each paroxysm was attended by opisthotonos so severe that the patient rested on the head and the heels. The exacerbation of the pain by movement may lead to temporary diminution of mobility, partly voluntary, partly of inhibitory origin. Herpes is very rarely, if ever, a consequence of true neuralgia, although pain so often accompanies herpes. The hair of the part may undergo changes; it may lose its pigment, fall off, or very rarely over grow. Anstie observed temporary grayness of a lock of hair after each attack, followed at last by permanent loss of pigment. (A very remarkable case has been recorded by Raymond, in which, at the time neuralgic pain in the head was most intense, all the hair of the patient [a woman aged thirty-eight] changed color from black to red, and in a few days to white, and then, in the course of fourteen days, fell off ["*Revue de Méd.*," September, 1882]).

Vaso-motor disturbance often accompanies a paroxysm. The first effect of the pain is usually to cause a constriction of

the vessels of the part, but this is often followed by their relaxation, flushing of the skin results, and the throbbing of the arteries may considerably intensify the pain. The arterial dilatation may be general, and be demonstrable by sphygmographic tracings (Anstie). In one case of trigeminal neuralgia all the veins of that side of the face became distended during the paroxysm, and as the pain subsided pallor replaced the flushing. The local vascular disturbance may cause local sweating, or local œdema, or even erythema, sometimes mistaken for erysipelas. The œdema thus produced is occasionally considerable: I have known each attack of cranial neuralgia to be accompanied by great swelling of the whole scalp, due to such œdema, which slowly disappeared some hours after the cessation of the pain. In another curious case, attacks of pain in the tongue and face were attended by swelling of each part, which usually came on during the night, and sometimes occurred with very little pain. Repeated attacks of such vaso-motor disturbance may lead to permanent dilatation of the vessels of the surface, and, after a time, to thickening of the cellular tissue, periosteum, and other structures.

Pathology.—Few questions have been the subject of more controversy than the pathology of neuralgia. The difference of opinion is largely due to the different senses in which, as we have seen, the word has been used. The problem of pathology is, What is the nature of nerve pain that has no known organic cause?

In neuralgia we have two symptoms, first, spontaneous pain, and, secondly, "hyperæsthesia" (more properly hyperalgesia), *i.e.*, the transformation into pain of sensations that are not usually painful (or excitation of pain by them); the former includes the latter, and therefore must be first considered. Spontaneous pain means the action of sensory nerve elements apart from local external stimulation. The pain corresponds to certain peripheral nerve areas, and we must therefore look for its cause to the elements constituting a peripheral nerve structure. These are the nerve fibres, their peripheral end organs and the central cells with which the fibres are connected. To which of these can we ascribe a functional activity independent of external stimulation? We know nothing of a capacity for such action on the part of nerve fibres. They possess a limited power of transforming external

energy into nerve force, which constitutes their "excitability," and they "conduct" nerve force, but there is no evidence to show that, apart from such external influences, they are capable of the independent evolution of nerve force. Nor are any facts known which would suggest that the peripheral end organs of the sensory nerves are capable of such independent function. We are thus reduced, by exclusion, to the central terminations of the nerve fibres as the source of the pain in idiopathic neuralgia. (The central theory has been adopted, among others, by Vulpian, Anstie, Clifford Allbutt and Vanlair, although the theories of these authors differ somewhat in their detail.) The fibres end in nerve cells, and nerve cells, as far as is at present known, are the only elements capable of the independent evolution of nerve force. The conclusion is further corroborated by physiological facts, which show that the sensation of pain depends on a special function of nerve cells. There are separate structures for the sensations of pain and touch; this is proved by the fact that either tactile or painful sensibility may be lost without the other. But nerve fibres are indifferent structures. Even between the fibres which conduct sensation, and those which conduct motion, there is no difference; the one may be experimentally substituted for the other without affecting function (Bidder, Vulpian and others), and it is therefore *a fortiori* probable that there is no difference between the fibres which conduct tactile and painful impressions. The different effect depends on the central connection of the fibres—on their nerve cells. Some of these, when stimulated by the afferent impulse, give rise to tactile sensations, others to pain, and it is probable that the former, when excited in a special manner or degree, may also give rise to pain. We must therefore regard the pain of idiopathic neuralgia as central (the central nature of idiopathic neuralgia was insisted on by the late Dr. Anstie [article, "Neuralgia," in Reynolds' "System of Medicine," and in the separate monograph, "Neuralgia, and its Counterfeits"], with characteristic ability, energy, and fertility of argument. But his position was unnecessarily weakened by the theory that the disease originated in the roots of the nerves as a "primary atrophy." At the same time it is right to say that some passages suggest that he included the nerve cells in which the fibres end in his conception of roots. That the seat

of the disease is frequently the sensory cells of the central nuclei has been urged by Vulpian and also by Vanlair ["*Les Nevralgies*," 1882]), as due to the spontaneous activity of the cells that constitute the central termination of the nerves. When an external cause (*e.g.*, an injury of the nerve) causes pain, the sensation is due to the stimulation of these cells, and the pain which results from their spontaneous "discharge" is necessarily referred to the region to which their fibres are distributed.

But the sensory fibres end in two sets of cells, those of the ganglia on the posterior roots, and those within the spinal cord, chiefly in the posterior cornua. There is no direct evidence to show which of these series of cells is concerned in neuralgia. But we know nothing of any sensory function of the ganglia, and we are therefore justified in looking to the nerve cells within the cerebro-spinal axis as the seat of morbid process.

This conclusion is indirectly corroborated by the symptoms of many cases of neuralgia. Especially significant are: (1) the fact that the pain may occupy adjacent parts of several nerve regions. For instance, in one patient the pain extended on both sides from the seventh cervical vertebra, over the whole occiput and vertex to the coronal suture. (2) The phenomenon of radiation of slighter pain into adjacent nerve regions during severe paroxysms. (3) The phenomena of reflex neuralgia, in which the pain is felt in another region than that of the nerve irritated. All these are explicable only on the theory that the morbid action, felt as pain, is in the central cells, which are no doubt connected according to the relations of the surface regions from which they receive impressions, and to which their disturbance is subjectively referred.

The same conclusion (the central nature of neuralgia) is also indirectly corroborated by facts of pathology of another kind which prove that pain of neuralgic character may be produced by an organic lesion in the gray matters which is here supposed to be deranged in idiopathic neuralgia. A lesion, for instance, involving part of the sensory nucleus of the fifth nerve, caused severe neuralgic pain in the face.

If, therefore, we regard idiopathic neuralgia as the result of the over-action, the "discharge," of the nerve cells constituting the proximate centre of the nerve, the question still

remains, To what is this discharge due? It is often ascribed to hyperæmia of the centre, to dilatation of its vessels. The possibility of this cause cannot be denied, but neither can its efficiency be proved. It is an hypothesis, moreover, which only solves one problem by the introduction of another. Vaso-motor disturbance means the deranged action of the vaso-motor centre for that territory, and it is as difficult to explain the disturbed action of the vaso-motor cells as of the sensory cells. All cells possess the power of evolving force; the discharge of the sensory cells is all we have evidence of, and it seems unjustifiable to assume the intervention of other cells for its production. But it is highly probable that secondary vaso motor disturbance may result. We know that in all organs vascular dilatation attends functional activity. If the cerebral cortex is stimulated by electricity, local dilatation of vessels quickly follows. It is probable that such secondary central hyperæmia may result from the discharge of other centres, and when established may increase the disturbance.

The over-action of the cells in idiopathic neuralgia has been spoken of as "independent." It is independent so far as our means of observation go. But we cannot tell to what extent the unstable cells may be excited to discharge by stimuli coming from the periphery. We know that some stimuli of this kind (cold or pressure) are effective in exciting attacks. It is highly probable that the afferent impressions of which we are conscious bear but a small proportion to those of which we are unconscious, which, continuous or intermittent, are due to slight cutaneous impressions, to the movement of the blood and to the nutritional processes in the tissues. It is quite possible that such afferent impulses, too trifling to affect our consciousness even when aided by attention, may excite the discharge of the unstable cells. That a strong sensory impression (*e.g.*, painful pressure on the nerve) may sometimes relieve the pain is quite in harmony with familiar facts as to the effect of sensory stimulation; a strong stimulus may inhibit reflex action which may be excited by a slighter stimulus in the same nerve region. These two facts deprive of much of its force an objection which has been often urged against the central theory of neuralgia, that the disease may sometimes be permanently cured by division of the nerve. Division of a nerve does two things, it stops all impressions from the per-

iphery, and it effects a very powerful stimulation of the centre, and to the conjoint effect of these two influences its success (not frequent) in idiopathic neuralgia may reasonably be ascribed. (It is possible, as Jaccoud has assumed, that the pressure acts partly by arresting the peripheral impressions. But that this is its chief action is doubtful, from the fact that pressure on another adjacent nerve is sometimes effectual, and so also is pressure on the peripheral side of the painful point. Cartaz has suggested that in the latter two cases the recurrent nerves may convey the pain and be compressed, but such an explanation does not apply to the effect of cutaneous irritation in arresting the pain, which is a phenomenon of the same class.)

We are accustomed to think of the sensory nerves as distributed chiefly to the skin, but the pain in neuralgia is rarely confined to the skin. It appears to the sufferer to be more deeply seated, and often corresponds in position to the nerve trunk and branches. The fibrous sheaths of both are abundantly supplied with nerves—the *nervi nervorum* (Sappey ["*Journal de l'Anat. et de la Physiologie*," vol. i., 1868, p. 47] has demonstrated their existence in the sheath of the optic nerve, and the fact mentioned in the text admits of no other explanation than the existence of similar nerves in all nerve sheaths, which has, indeed, been demonstrated by Horsley ["*Proc. Roy. Med. and Chir. Soc.*"], 1884, and Appendix to Marshall's "*Bradshaw Lecture*," 1887), which ramify and end in the sheath without penetrating the inter-fascicular septa. If a nerve is compressed (as the ulnar at the elbow) the first sensation experienced is a pain at the spot, from the stimulation of the sheath nerves; if the pressure is continued there is also a sensation (tingling) referred to the peripheral distribution of the nerve in the hand, due to the stimulation of the fibres of the nerve itself. In neuralgia, the central cells of the sheath fibres often seem to be disturbed in function more than those of the fibres of the nerve itself; the pain is referred to the nerve trunk rather than to the skin.

The fact that the pain seems to dart along the nerve must be due to the spread of the discharge in the centre in a certain order from cell to cell. We cannot at present say precisely on what this depends, or why the pain seems sometimes to dart toward, and sometimes from, the periphery. (An in-

genious hypothesis has been formulated by Vanlair, which may be mentioned. According to Pierret there is a relation between the length of a nerve fibre and the size of its cell. The sheath nerves will vary in length according to the distance from the centre at which they terminate. If the cells discharge in the order of their size, beginning with the smallest, the sensation will seem to dart centrifugally. For the apparently centripetal direction, a still more complex hypothesis has been suggested. Most nerves contain recurrent fibres which proceed from adjacent nerves [Magendie, Arloing, and Tripier]. These recurrent fibres ascend the branches and trunk, but all cease before the foramina of exit are reached. If these end in the nerve sheath, the same hypothesis applied to the recurrent fibres will serve to explain the centripetal darting; the longest fibres, which end nearest the centre, will have the largest cells, and discharge last. Unfortunately, we do not know that any of the recurrent fibres end in the nerve sheath, and if they do, it is probable that their central connection is the same as that of the direct fibres. It seems more probable that the arrangement of the cells in the centre depends on the distribution of the fibres in the sheath, and that this arrangement, and not the size of the cells, determines the order of the discharge, which may traverse the centre in opposite directions in different cases, just as in one epileptic an aura may pass down, and in another up, the arm.)

The irradiation of the pain, in severe attacks, to neighboring nerve areas is clearly, as already mentioned, a central phenomenon. An intense discharge always tends to spread to other connected cells, in proportion to its intensity, as the phenomena of epilepsy abundantly illustrate.

The origin of the tender points is obscure, and has been the subject of much speculation. (The hypothesis [of Cartaz and others] which connects these tender points with the distribution of the recurrent nerves, rests on too many unprovable assumptions to deserve detailed description.) Their localization to the places at which nerves emerge from deeper structures, or divide, suggests their dependence on mechanical causes. Accidental pressure, and traction in movement, will have most influence on the nerves at such places, and cause there a greater degree of stimulation of the *nervi nervorum* (Vanlair). Many phenomena of neuralgia suggest, moreover,

that a neuralgia which is at first purely central may not remain so. We have seen that the pain often causes secondary vascular disturbance in the territory of the nerve. It is most unlikely that such disturbance, conspicuous in the skin, is confined to the surface. It probably involves, also, the deeper structures, and especially the nerve sheaths, in which the pain is especially localized. Such secondary vascular disturbance, and the tissue changes to which it ultimately leads, must constitute a source of irritation of the *nervi nervorum*, and, in a truly "vicious circle," must intensify the malady, which, at first central, may be thus, at last, peripheral also. It is probable that this mechanism takes an important share in the production of the tender points, and is also the cause of the intractability of some neuralgias.

Not only is it probable that peripheral disturbance takes part in the pathogenesis of central neuralgia, but it is certain that central disturbance is concerned in some neuralgias of peripheral origin. A traumatic cause, an injury to a nerve branch, may induce pain far wider in area than the distribution of the injured branch, or even of the nerve from which it comes. In some cases, again, the pain is felt not in the area of the nerve injured, but in that of some other nerve (reflex neuralgia). An interval usually elapses after the injury before the pain is felt. Lastly, in some traumatic cases, division of the nerve does not cure the neuralgia. These facts can only be explained by assuming that the chief cause of the pain is a morbid state of the central cells, excited by, but to some extent independent of, the peripheral lesion. Doubtless, in all neuralgias of "symptomatic" character, the symptoms depend, in varying degree, on an induced central disturbance.

Various Forms.—Cases of neuralgia differ much according to their situation, character, and cause, and hence it is necessary to describe in some detail the varieties of the disease. According to situation, we have to consider separately those which occupy the head, neck, arm, trunk, and leg. According to character, we have "epileptiform neuralgia," and "reflex" or "sympathetic neuralgia," while of those which depend on special causes the most important are the traumatic, herpetic, anæmic, malarial, syphilitic, and diabetic forms.

It is important to remember that neuralgia is often not confined to a single nerve. Those who are liable to the affec-

tion in a high degree sometimes suffer from neuralgia in many situations, simultaneously or in succession.

VARIETIES DEPENDING ON SITUATION.

Neuralgia of the Fifth Nerve. Trifacial or Trigeminal Neuralgia; Tic Douloureux; Prosopalgia.—Under these various designations the most common form of neuralgia has been described. Neuralgia of the fifth is probably more frequent than all the other varieties together, and it presents, in most typical forms, the characteristic symptoms of the disease. Nor is this surprising when we consider that the fifth is incomparably the most important nerve of common sensibility in the body.

The causes of this form are all those that have been described in the section on etiology; indeed, the general history of neuralgia is, to a large extent, based on the symptoms of this variety. It is equally common on the two sides. The seat of the pain may be in any of the three divisions of the nerve; and it more commonly occupies one or two of the divisions than all three. The tender points are often well marked, and in them the pain has its chief intensity.

Neuralgia of the first division is felt chiefly in the supra-orbital branch, and hence is often called supra-orbital neuralgia. The frequency with which it was formerly due to malaria has left for it the popular name of "brow ague," although this cause is now rarely operative in this country. The pain radiates from the supra-orbital notch over the anterior half of the head, and is often felt in the eyelids and even in the eye, and in the side of the nose. The most important tender points are the supra-orbital, just above the notch or foramen of that name; a palpebral, in the outer part of the upper eyelid; a nasal, at the emergence of the nasal branch at the lower edge of this bone, and sometimes an ocular, within the eyeball. Pain felt just above the eyebrows is sometimes due to a morbid state of the frontal sinuses, but pain from this cause is generally double, and is often secondary to coryza. The lining membrane of the sinus is supplied by the fifth nerve, and it has been conjectured that the pain occurs when the small opening of the sinus into the nasal cavity becomes closed. Seeligmüller thinks that this is the cause of the pain even in

malarial cases. But the nerves of the sinus (or their centres) seem to be particularly obnoxious to certain influences, as is shown by the peculiar pain, evidently referred to these sinuses, which many persons experience after eating ices. We cannot, therefore, conclude that because the pain occupies this situation, it is necessarily due to a local cause. The supra-orbital region is a not uncommon seat of pain that is apparently neuralgic. This does not follow the course of the nerves, but it may be felt sometimes over one eye, sometimes over both.

Ocular Neuralgia.--The eyeball is an occasional seat of neuralgic pain, often of considerable severity. This is sometimes associated with some error of refraction, especially hypermetropia, but occurs also independently of any abnormality of the eye itself. Either one or both eyes may be affected. The pain may occur spontaneously, or may be brought on by use of the eyes; it is not often accompanied by photophobia. When severe, there is occasionally dimness of sight, apparently of inhibitory origin, and the amblyopia may be accompanied by a peripheral restriction of the field of vision. Ocular neuralgia may exist alone, or be associated with pain in adjacent parts, and sometimes with pain that extends far beyond the limits of the fifth nerve. Bilateral pain sometimes passes from the eyes over or through the head to the occipital region, and even down the neck. Anæmic girls often complain of a peculiar dragging pain at the back of the eyes, increased by their use. Ocular pain is often associated with rheumatism; the subjects of rheumatic iritis are often liable to pain in the eyeballs, which seems to be neuralgic in character.

In neuralgia of the second division, infra-orbital neuralgia, the pain occupies the area between the orbit and the mouth and extends over a great part of the cheek, and to the ala nasi. The chief foci of pain and tender points are an infra-orbital, at the emergence of the nerve beneath the orbit; a nasal, at the side of the nose; a malar over the most prominent part of that bone, and a gingival line below that bone, along the line of the gums of the upper jaw; very rarely there is a point in the palate, or in the upper lip. The most acute pain is often felt only in one portion of the nerve, as, for instance, the side of the nose; but it usually radiates, in a slighter degree, over a wider extent.

When the third division is affected, the pain often extends

over a large area, occupying the parietal eminence and the temple, the ear, the lower jaw, and the tongue. The chief tender points are the inferior dental, at the foramen of that name; the temporal, in the posterior part of the temple on the auriculo-temporal branch; it may be a little lower down, just above the zygoma in front of the ear, and is a very common focus. The parietal, over the parietal eminence, is common to this and to occipital neuralgias. Sometimes there is a focus of pain in the tongue. Separate portions of this branch are sometimes affected alone, especially the inferior dental and the auriculo-temporal. A boring pain limited to the temporal point is especially common. Most intense neuralgia is sometimes confined to the lingual branch. Occasionally, a tender point exists in the cervical spines, at the first two or at the fifth (Armaingaud), its exact cause is obscure.

The pain in trigeminal neuralgia is often peculiarly intense and presents every variety. It may radiate from one part of the fifth nerve to the next, and even to other nerve regions. Thus, in one case of violent neuralgia of the second division of the fifth, the pain often radiated to the occipital region and sometimes to the shoulder on that side. The effects of cold and contact in exciting the pain are well marked, and it is often increased by movement of the face or jaw, so that, in severe cases mastication may be impossible and it may be difficult to give sufficient food. If the ear is the seat of pain, either alone or with other parts, the attack may be accompanied or followed by auditory hyperæsthesia. When the pain is very acute and sudden, reflex muscular spasm may occur in the face (the "tic convulsif" of the French). Paralytic phenomena are rare, but transient paralysis of the third nerve has been observed to follow each paroxysm of pain in the supra-orbital branch. Sometimes paroxysms of severe pain in the fifth nerve are accompanied by subjective flashes of light, especially when the eyeballs are the seat of pain. The vaso-motor disturbance already described is frequently seen, flushing, sweating, permanent dilatation of the vessels (often conspicuous in the eye), salivation, increased secretion of mucus in the nose, lachrymation. Trophic disturbances occasionally occur; acute, as erythema; or chronic, as thickening of the periosteum, loss of hair, or local grayness. Even unilateral atrophy of the face has been met with (Boisson). It is probable that in many of

these cases the pain was the result of actual changes in the nerves. The course of the fifth in the base of the skull through the membranes and bony foramina exposes it to damage from many morbid processes, and causes its fibres to suffer when there is any inflammatory swelling of the sheath.

Occasionally migratory pains are felt in various parts of the scalp, sometimes on one side, sometimes on the other, without any distinct relation to the nerve trunks. There may be tenderness of the skin during and after the paroxysms of pain. This form is sometimes more closely allied to rheumatism than ordinary neuralgia is. Rarely there is neuralgic pain over the whole scalp at the same time, so that, as one patient expressed it, there is "a cap of pain on the head." Pain at the vertex is a common form of headache sometimes closely allied to neuralgia, and it may alternate with characteristic neuralgic pains in other situations.

Cervico-Occipital Neuralgia.—The pain is felt in the region of the neck supplied by the first four cervical nerves and in the posterior portion of the head, chiefly along the course of the great occipital nerve. Thus the pain may extend over the greater part of the neck as well as over the head as far forward as the parietal eminence and the ear. It is occasionally confined to the posterior branches, extending over the back of the neck and occiput. The most important tender points are (1) about midway between the mastoid process and the spine at the point at which the great occipital nerve becomes superficial, (2) over the branches of the cervical plexus between the sterno-mastoid and trapezius, and (3) just above the parietal eminence, the focus common to occipital and trigeminal neuralgia. Fusion of these two forms of neuralgia occurs, so to speak, not only above but below where the distribution of the cervical nerves blends with that of the third division of the fifth over the lower jaw. A primary cervical neuralgia may extend into this region of the fifth; doubtless the centres blend as does the distribution. It is probable that cervico-occipital neuralgia is more often bilateral than any other form, especially when confined to the occipital region. I have known most severe bilateral neuralgia to be limited to the anterior cervical region from the jaw to the upper part of the thorax on each side. The pain in cervico-occipital neuralgia is rarely intermitting; there is more or less dull constant

pain with occasional exacerbations, less violent than in the trigeminal form. The scalp may become extremely tender, so that during the pain the patient cannot bear the hairs to be touched. This form of neuralgia is not common, and Anstie believes that it occurs especially in those who have suffered from other forms.

Cervico-brachial and brachial neuralgia includes those forms in which the pain is referred to the region supplied by the four lower cervical and the first dorsal nerves. The pain may be felt in the lower and posterior part of the neck or any part of the arm and hand, but is commonly most intense in the axilla at the brachial plexus and along the course of the ulnar nerve. The region of the last is a very frequent seat, but sometimes the pain is referred to other nerves. It is commonly increased by movement and may render the arm almost useless. It is often excited by writing, and this may give rise to an erroneous impression that it is connected with the act of writing. Some severe forms of brachial neuralgia indeed have their origin in a sensory occupation neurosis. The most common tender points in brachial neuralgia are the axillary; the circumflex at the posterior border of the deltoid; a superior ulnar behind the elbow, and an inferior ulnar in front of the wrist. The latter is the most frequent of all the brachial foci. Others occasionally met with are the vertebral, by the side of the lower cervical spines; a scapular, at the inferior angle of that bone; an external humeral, on the outer side of the arm three inches above the condyle over the musculo-spiral nerve; and a radial, in the lower and outer part of the forearm. There is usually some constant pain in addition to the acute paroxysms. Occasionally it may radiate to the side of the chest, and then if on the left side may simulate angina pectoris. The pain is almost always intensified by movement. Trophic disturbance in the arm is very rare in cases of true neuralgia, and indeed probably always indicates neuritis. When the pain starts from the fingers it may begin with some sensation other than pain, such as tingling, which changes to pain as it passes up the arm. In some patients with brachial neuralgia the arm is peculiarly liable to be the seat of tingling at night. Brachial neuralgia is not often due to diathetic causes, with the exception of rheumatism, with which it is often associated even when there is no suspicion of

neuritis. On the other hand it is more frequently than any other as the result of injury. Probably many cases of supposed neuralgia are really cases of neuritis of the brachial plexus which may arise by migratory inflammation. But true neuralgia of the arm widely spread may be set up by a slight injury, as a blow which does not apparently cause neuritis. Brachial neuralgia is occasionally associated with neuralgia of the fifth, and this when there is no connecting pain in the neck.

Trunk Neuralgia.—Of the neuralgias of the trunk we have first the dorso-intercostal forms, which occupy the intercostal nerves from the third to the ninth, characterized by pain coursing along the intercostal spaces or parts of them. It is sometimes bilateral and symmetrical. There is usually a constant dull pain with acute stabbing exacerbations, but sometimes the continuous pain exists alone or the sharper pains are excited only by movement, respiratory or other. There are foci of intensity and tender points at the emergence of the three branches of the intercostal nerve—besides the vertebræ near the middle line in front and midway between these two points in the mid-axillary line. Intercostal neuralgia is most frequently due to cold or to injury, such as a contusion. It is sometimes extremely obstinate and of long duration.

The thoracic wall is also the seat of more trifling neuralgic pains; one of these is pleurodynia, which differs from true intercostal neuralgia in being usually localized at one spot not corresponding to the course or exit of the intercostal nerves. It appears to be a true neuralgia, distinguished from myalgia by the fact that it is local, very acute in character, and is excited by expansion of the thorax rather than by lateral movements of the trunk. The theory that it is a neuralgia of the pleural nerves has much probability. Another common neuralgic pain is the infra-mammary pain of anæmic women. Very limited in position it is more or less constant, and is rarely increased by respiration to such an extent as to interfere with the free expansion of the thorax. The relation between intercostal neuralgia and pulmonary trouble is a difficult subject on which satisfactory facts are difficult to obtain and few observers have ventured to corroborate the statement of Woillez that acute intercostal neuralgia is always accompanied by a secondary congestion of the lung. It is more

probable that when this association exists the true relation is the reverse. The intercostal nerves are frequently the seat of herpetic neuralgia.

The neuralgias that occupy the lower half of the trunk have been grouped as lumbo-abdominal. The pain has a course similar to that of the intercostal form. Foci of pain and tender points are found at the back; beside the vertebræ over the posterior branches; at the middle of the iliac crest (iliac point); at the lower part of the rectus (hypogastric point), while sometimes there is in the male a scrotal and in the female a labial point. These pains are often bilateral and may change their position from time to time. They are generally acute pains, but now and then have a constricting character like the girdle pain of organic disease, but distinguished from them by their irritability. Lumbo-abdominal neuralgias seem to be sometimes secondary to disease of the pelvic organs, especially in the female. Neuralgia in the penis sometimes results from masturbation. It may also be due to lithæmia, and from this cause I have known it to be most severe and long continued.

The spinal column is a very common seat of neuralgic pain, especially in weakly women and after concussion of the spine. It constitutes one of the most troublesome of the many pains of hysteria, and one of the most enduring consequences of railway accidents. The pain is in most cases felt through a considerable vertical extent of the spine, and is specially intense in certain spots, commonly in more than one. The dorsal region is the most common seat, next the lower cervical, and least frequently the lumbar region. Sometimes the pain is localized on one side of the spine, close to it. The pain felt in the spine in cases of gastric ulcer seems to be a sort of reflex neuralgia. Often the pain seems to pass up to the back of the head. Spinal neuralgia may be associated with a similar pain in some other part of the trunk, shoulder, arm, or leg. It is usually accompanied by considerable tenderness, and is increased by fatigue, by use of the legs, by long sitting or standing, and also by vibration, such as the movement of a carriage. The latter point is often of considerable diagnostic importance, for it is far more marked in neuralgia than in spinal disease causing pain. On the other hand the pain is not increased by

slight movement, as is the pain of growths and caries. The pain is seldom distinctly paroxysmal, but as already mentioned in one case, paroxysms of pain in the cervical spine and vertex were most intense, and each was accompanied by opisthotonos. It is uncertain in what structure this spinal neuralgia is produced. It is often associated with neuralgia elsewhere, and also with rheumatism of the fibrous tissues, so that some cases seem to be of the nature of rheumatic neuralgia. It has been thought that the membranes are the seat of the pain, but there is no real evidence for or against the theory.

Another very common seat of neuralgia is the sacral region, no doubt in consequence of the plexus of nerves that lies between the bone and the skin. Pains of pelvic origin are often referred to this region, as those of parturition show. Occasionally the pain is felt chiefly about the coccyx—coccydynia it has been termed. It must be remembered that the fibrous tissues over the sacrum are sometimes the seat of acute rheumatism, such as higher up gives rise to lumbago.

Neuralgia of the Leg.—In the lower limb, neuralgia is rare in the region supplied from the lumbar plexus, although a crural form, in which the pain occupies chiefly the front of the thigh, is occasionally met with. In most instances pain in this region is of secondary origin, due to a lesion of the lumbar plexus, as, for instance, from the pressure of an abdominal tumor, or is due to the extension of neuritis from the sciatic up the lumbo-sacral cord.

The majority of neuralgic pains in the leg are in the region of the sciatic nerve, and are grouped under the designation of sciatica. The pain occupies especially the course of the nerve, but tender foci are met with in certain spots; lumbar, near the spine, just above the sacrum; sacro-iliac, at the articulation of the same name; a gluteal opposite the middle of the lower border of the gluteus; a series of spots varying in exact position, along the course of the nerve in the posterior aspect of the thigh; a peroneal behind the head of the fibula; and a malleolar behind the lower extremity of the fibula, and an external plantar at the outer border of the foot. It is, however, certain that sciatica is seldom a true neuralgia. Almost all severe cases are due to inflammation of the nerve trunk.

Lastly, it should be mentioned that in rare cases neuralgic pains are felt almost everywhere, in the limbs, trunk, and head, and apparently constitute a sort of universal neuralgia. The few cases I have seen have been in adult men, and associated with hypochondriasis.

VARIETIES DEPENDING ON CHARACTER.

Epileptiform Neuralgia.—The term is applied (according to the example of Trousseau) to an intractable form, in which each attack of pain comes on very suddenly, with intense severity, and lasts usually less than a minute, sometimes only a few seconds, rarely for two or three minutes. The frequency with which the attacks recur varies in different cases; the daily number may be one or hundreds. The pain is most intense, so that the patient stamps about the room in agony, or tries to get relief by violent rubbing or by pressure. Trousseau relates the case of a lady whose malar bone was atrophied in consequence of the pressure, repeated every few minutes for years. The sufferers from this terrible form are usually in the second half of life. The pain is invariably in the region of the fifth nerve, sometimes in the whole, sometimes in part only, but rarely confined to a single branch. Convulsive spasm in the face may accompany the pain (convulsive epileptiform neuralgia).

Reflex or sympathetic neuralgias are those in which the pain is felt in another nerve region than that in which its cause exists. The radiation of neuralgic pain must, as already stated, be ascribed to the extension of the central discharge to adjacent centres, but the term "reflex neuralgia" is not applied to these cases, but to those either in which the pain exists only at a distance from its cause, or in which the distant neuralgia has no sensory continuity with the primary pain. The pain of a carious tooth may be associated with a distant and apparently disconnected pain in some other part of the fifth nerve, or such disease may cause only distant neuralgia, and no local pain. The proneness of the fifth nerve to be affected in neuralgia renders it a common seat of the reflex form. For instance, neuralgia limited to the fifth has been produced by injury to the ulnar nerve, and to the occipital nerve (Anstie). Nevertheless, the converse relation is some-

times observed; carious teeth are said occasionally to cause neuralgia in other parts, as, for instance, in the cervico-brachial region (Salter). When no local pain is felt, we must assume that the centre to which the afferent impressions directly come is not thus excitable to painful activity, or even so as to influence consciousness, but that it is in connection with another centre which, by natural or acquired susceptibility, is disposed to excessive action. Curious cases are on record in which the act of micturition invariably caused a pain in the region of the arm supplied by the ulnar nerve. (Several such cases are given by Vanlair ["*Les Neuralgies*," p. 330]; one of them comes from a curious source—the autobiography of Clarendon, Chancellor to Charles II. See p. 8.)

The cause and seat of reflex neuralgia may be most varied. When due to causes acting on the cerebro-spinal nerves, the pain is usually felt on the same side, and rarely far distant. A most important class of reflex pains are those which are produced by disease of the internal viscera, such as the spinal pain in ulcer of the stomach, the sacral pain in uterine disease, the scapular pain in affections of the liver, the pain in the testicle in renal colic, and pain in the front of the thigh and spine in gonorrhœal orchitis (Mauriac). Many of these are rather reflex pains than neuralgias properly so-called, but they occasionally persist when their cause is removed, or assume disproportionate intensity. They are of very great practical importance on account of the readiness with which their cause may escape attention.

Traumatic neuralgias are those that are excited by injury to nerves—by contusion, and by punctured, lacerated, or incised wounds. In some instances the pain is the result of a neuritis, set up by the injury, which may ascend the nerves and pass, at a junction, to other trunks. But neuralgia may also be set up when there is no more than the local and transient inflammation at the spot injured. Such neuralgia may follow nerve lesions in any part of the body, but is especially frequent in the arm, the nerves of which are much exposed to injury. In the days of venesection, a common form of neuralgia resulted from injury to a cutaneous nerve in the operation. It may follow wounds of both large and small nerves, and by some observers has been thought to be more frequently due to the latter, but it must be remembered that small nerves

are more often wounded than larger trunks. Anstie believes that neuralgia is more common from partial injuries than when the nerves are completely divided. It is a frequent consequence of gunshot injuries of nerves. In some cases the disease is apparently due to the implication of nerves in a cicatrix, or to the morbid enlargement of the nerve ends after amputation, which goes by the name of "bulbous nerves."

The pain may commence a few hours or days after the injury, but more frequently not until after an interval of some weeks or months. It generally begins in the point injured, but is rarely limited to this, or even to the part supplied by the wounded branch. It usually radiates to adjacent regions, and sometimes to parts supplied by other nerve trunks. For instance, a woman received a blow on the thorax, probably confusing an intercostal nerve. The early pain of the injury ceased, but two months later neuralgic pains commenced at the spot and gradually spread over the whole region supplied by the cervical and brachial plexus (Ollivier). The pain may be less intense at the seat of the injury than it is elsewhere, and it may even be absent at the seat of injury, and then is of the purely reflex variety, instances of which have been already mentioned. These facts, and also the circumstance that the pain is not always influenced by excision of the injured nerve, show clearly that it is to a large extent of central origin, the expression of a disturbance which, though excited by the nerve injury, is to a considerable extent independent of it, and doubtless due, not only to the excitant, but also to a predisposition, such as is concerned in the production of other neuralgias. The same fact is seen even more clearly in cases in which some injury leaves a slight local weakness or disability, and years afterward the part may become the seat of neuralgic pain, under the influence of a constitutional tendency.

The pain is usually intermitting in character, but often most intense in degree and causes profound depression of the general system. It may excite muscular spasm, and, especially at the onset soon after the injury, other reflex symptoms, such as vomiting. Vaso-motor disturbance occasionally ensues; trophic changes in the skin and joints have been described, but it is very doubtful whether nutrition suffers except in consequence of considerable secondary neuritis. The course

of traumatic neuralgia is often tedious, sometimes most prolonged, and it has been known to last to the end of life, in spite of every medical and surgical measure that could be devised for its relief. When it ceases, it is prone to recur under the influence of general depressing influences.

Occupation Neuralgias.—These are pains, more or less neuralgic in character, brought on by some habitual act. They are the sensory forms of occupation neuroses.

Herpetic Neuralgia.—Herpes zoster, whatever its seat, is usually accompanied by pain of a neuralgic character. The explanation of this is found in the conclusive evidence that the eruption is the effect of nerve irritation, probably always inflammatory in character. It always corresponds in area to the distribution of certain nerves, and, post-mortem, inflammation has been found in the nerve (Haight) and in the ganglia of the posterior roots (Bärensprung, Charcot, etc.). The neuralgic pain is thus "symptomatic," the result of organic changes in the nerves. Sometimes herpes occurs in the area of a nerve which has long been the seat of neuralgic pain, and hence is regarded as an occasional trophic effect of neuralgia, but it is an extremely rare consequence, and probably only occurs in cases in which the pain is the expression of organic changes in the nerve, and is not a consequence of simple idiopathic neuralgia.

In cases of ordinary zoster, pain may occur before or after the eruption. The initial pain precedes the appearance of the eruption for a few hours or days, is usually moderate in severity, and commonly (but not always) subsides as the cutaneous lesion is developed. Sometimes this pre-herpetic pain is absent, especially in the young, although even then there is usually an initial sensation of tingling in the part. The pain that succeeds herpes is more constant. It comes on usually during the decline of the eruption, and its occurrence bears no relation to the seat of the herpes. The most common situations for neuralgia are those in which herpes is most common: the side of the trunk, the forehead, neck, and leg. The pain has the distribution of the eruption, corresponding to the nerve or nerves affected. It varies in degree, but is usually acute, lancinating, and for a time severe, and is accompanied by great tenderness of the skin. The same tender points are met with as in ordinary neuralgia in the same area. There is an

important relation between the age of the patient and the severity and duration of the pain. In old persons it constitutes one of the most severe and persistent forms of neuralgia, often continuing for months and even years before, at last, it slowly lessens. Occasionally, it persists in unmitigated intensity to the end of life. Sir William Jenner, in his lectures, was accustomed to illustrate the obstinate persistence of this pain in the old, by the instance of a man who, before the days of anæsthetics, endured the excision of the skin to which the pain was referred, in the hope of relief, but found none, and then, unable to bear the continuous agony, he shot himself.

Hysterical Neuralgias.—Neuralgic pains are common in hysteria, but a distinction must be drawn between those which are merely associated with, and those which are due to, the general neurosis. Of associated forms, every variety of true neuralgia may be met with, due to the neuropathic disposition, which is also the cause of the hysteria, and they present the characteristic distribution, tender points, etc., of the ordinary form. Anæmic neuralgias are also common in hysterical patients, in whom the nerve disturbance is often due to poorness of blood. Of the neuralgic pains that are due to hysteria, some are in the cerebro-spinal system, some in that of the sympathetic. Certain local pains in the head are very common, but these differ from ordinary neuralgia in being confined to one small spot, instead of following the course of nerves, and the local pain has a sharp stabbing or boring character, as if a nail were being driven in, and hence has received the name of "clavus hystericus." It is important to remember that a similar pain may be met with apart from hysteria, especially in anæmic persons. Pains in the spine are also extremely common, sometimes very local, and of various characters. Other pains referred to the trunk are usually associated with local tenderness, in the so-called "hysterogenic points." The most important neuralgias of hysteria are those of the viscera, ovarialgia (not necessarily in the ovary itself), and gastralgia, being the most frequent. Pains in the joints and muscles are also common. The visceral neuralgias, and those associated with parietal tenderness, are usually persistent, but the local boring pains, and those in the joints and muscles, are often fugacious and migratory, and this constitutes a diagnostic point of considerable importance.

Rheumatic Neuralgia.—In a loose way, all neuralgias produced by cold are sometimes styled “rheumatic,” but the mere causal relation scarcely warrants the epithet. The peculiar affection termed “muscular rheumatism” is also sometimes called a rheumatic neuralgia, but this is to extend the use of the term in a manner that is scarcely justified or needed. Pain that occurs only on movement should never be called neuralgia. Acute articular rheumatism is rarely associated with true neuralgia, but some forms of spontaneous pain are frequently produced by cold in those who present what is termed the “rheumatic diathesis,” who perspire easily, are liable to catarrh, and whose urine readily becomes loaded with lithates after a chill. Such pains may correspond to a certain nerve, or may occupy some part of a limb, without any definite relation to nerves, and are often migratory. Their exact pathology is uncertain.

Gouty Neuralgia.—The subjects of gout not unfrequently suffer from nerve pains, apparently idiopathic in character, coming and going, and sometimes very severe. The pain may disappear when an attack of acute gout is developed. The fifth nerve, the intercostals, and the sciatic are those most frequently affected. Severe sciatica sometimes occurs in the gouty, but is certainly due to neuritis. One visceral neuralgia is also sometimes due to gout, gastralgia.

Diabetic Neuralgia.—Patients with diabetes may suffer from neuralgic pains that have no special characters, but Worms has called attention to the symmetry of the pains, which occupy the same nerve on both sides, as a characteristic of diabetic neuralgia. The pain has hitherto been observed chiefly in the third division of the fifth nerves and the sciatics. It must be remembered, however, that ordinary neuralgia is occasionally symmetrical. The nerve pains met with in diabetes are often severe and obstinate until the cause is removed by dietetic treatment. They have been observed to increase and decrease with the amount of sugar in the urine. Ziemssen has suggested that they may be sometimes the result of a peripheral neuritis analogous to that which is met with in alcoholism. While there is some evidence that such neuritis may occur in diabetes, it seems improbable that it is the cause of the pains commonly met with.

Anæmic Neuralgia.—Anæmia is one of the most powerful

causes of neuralgia in all its forms, but certain varieties are more frequent than others in this condition, especially in young women. One of these is situated in the fifth nerve, either in the first division or in the auriculo-temporal branch. It is generally intermittent and is increased by movement, while it is lessened by the recumbent posture. Another, still more frequent and more continuous, is that which is felt in the thorax, in the fifth and sixth interspaces on the left side, the well-known infra-mammary pain. Gastralgia is also common apart from ulcer. Headaches that have no true neuralgic character are also very common.

Neuralgia of the cerebro-spinal nerves sometimes occurs in lead poisoning, but it is uncertain whether it is the result of the toxic influence or of the anæmia which this causes. The knowledge of their cause, however, is very important. According to Briquet, lead colic is in part a neuralgia of the abdominal wall, but the evidence of this is scarcely satisfactory.

Malarial neuralgias are not very common even where ague is frequent. They present nothing characteristic in seat, although the supra-orbital and intercostal forms are the most frequent; nor is there anything special in the character of the pain. Their chief feature is regular periodicity, the intervals between the attacks being from one to four days. The periodicity is less characteristic when the attacks are diurnal than when three or four days intervene. Occasionally the paroxysms are attended with slight symptoms of an ague fit, a trifling cold and hot stage (Anstie). They must not be confounded with the vaso-motor phenomena met with in cases of the ordinary form. It is very doubtful whether the neuralgia is, in most cases, a direct effect of the malarial poison, in the sense in which ague is. It is probably an indirect effect, the result of the anæmic and depressed state of the nervous system induced by malarial influences, even in those who do not suffer from intermittent fever. Neuralgia, apparently due to malarial causes, does not always yield to quinine, even when given in the most approved manner. It is probable that the exact periodicity of many malarial neuralgias is the result of the state of the nervous system produced by the poison, and it does not prove the neuralgia to be truly malarial. In some cases of supra-orbital neuralgia with exact periodicity coming

from malarial districts (recorded by Seeligmüller), quinine failed entirely while other treatment was quickly successful.

Syphilitic Neuralgia.—The pains of syphilis constitute a prominent symptom of that disease, but, for the most part, have no correspondence with nerve distribution, and can therefore be scarcely regarded as neuralgic. Symptomatic neuralgic pains occur in many syphilitic affections of the nervous system which cause irritation of the nerves or their roots, in chronic meningitis, neuritis, and pressure from growths. One of the most severe and obstinate cases of pain in the region of the fifth nerve I have seen, was due to chronic syphilitic meningitis at the origin of the nerve. In such cases the nature of the lesion is usually clear from the evidence of structural damage to the nerve fibres. In the case just mentioned, for instance, there was anæsthesia and paralysis of the masseter. Whether idiopathic neuralgia results from the influence of the syphilitic poison is uncertain. Fournier believes that such neuralgia is common during the secondary stage, but very few conclusive cases have been recorded. It must be remembered that in the early stage of neuritis, etc., pain may be the only symptom, and, on the other hand, the anæmia which results from syphilis may be the real cause of the neuralgia. Anstie believed that syphilis does not cause true neuralgia, although it may recall a neuralgia which had long ceased. A peculiarly distressing post-sternal pain, apparently neuralgic in character, has been occasionally observed in constitutional syphilis (Eccheverria, Buzzard).

Degenerative Neuralgia.—In advanced life, and sometimes before the senile period is reached, neuralgia is occasionally met with, of extreme obstinacy, and associated with other signs of degeneration of the central nervous system, such as failure of memory or persistent mental depression. The neuralgia is apparently one effect of a degenerative tendency. The affection has all the characters of a central neuralgia. The fifth nerve is by far the most common seat, but the pain sometimes occurs in other situations.

Diagnosis.—The diagnosis of neuralgia rests on the unilateral situation of the pain, on its correspondence to the distribution of certain nerves, its intermitting or remitting character (*i.e.*, the occurrence of paroxysmal exacerbations), on the fact that the patient has suffered from similar pains elsewhere,

on the variations in the seat of the pain, and on the absence of any indications of actual damage to the nerve fibres. The variability is a symptom of great importance. If the pain shifts about, now in one spot and now in another, it is not likely to be due to an organic cause. For instance, a man with fronto-occipital neuralgia had foci of pain in the forehead, temple, and occiput, but he never had pain at the same time at more than one of these places. The last of the above indications, however, is the most important element in the distinction of neuralgia from the similar pains which result from organic disease of the nerves due to external pressure or neuritis. It is in the case of the fixed neuralgias (as distinguished from the migratory forms) that the distinction is of chief importance. The diagnosis is more difficult in the case of neuritis than of external pressure (tumor, etc.), because, in the latter case, the cause of the pressure usually produces other symptoms, and the effect of the pressure is progressive, so that gradually increasing signs of a structural lesion are added to the pain. But from neuritis the distinction may be much less easy. The difficulty is the greater, the slighter the degree of neuritis. Severe inflammation causes severe constant pain, at first more intense at its seat than in the distribution of the nerve, because the inflammation is most intense in the nerve sheath, and the sheath nerves suffer first. In severe forms, however, the proper fibres of the nerve are soon implicated to a degree that interferes with their conducting functions, so as to cause at first persistent hyperæsthesia, and then areas of anæsthesia, while if the nerve is "mixed," the muscles supplied become weak, flabby, and rapidly waste, with changes in electrical irritability. In slight cases, on the other hand, the sheath chiefly suffers; there may be no interference with conduction, and the pain resembles neuralgia more closely, although, as a rule, it is more continuous than in true neuralgia. The diagnosis is also difficult when the seat of the neuritis is such as to render the nerve inaccessible to direct examination. If it can be reached, there will be found from the first local tenderness of the nerve. In idiopathic neuralgia tenderness of the trunk in the intervals is only developed after the neuralgia has existed for some weeks. Moreover, in neuritis distinct swelling of the nerve can sometimes be felt. Local tenderness is thus chiefly of significance in the early

stage of the affection, or when it occupies a considerable area of the nerve trunk, and is not confined to certain points.

If, therefore, the pain is migratory, if it is completely intermittent, especially if the intermissions are of long duration, if the attacks are induced by psychical influences, the suspicion of an organic cause will scarcely arise. If, on the other hand, there is continuous pain, rapidly developing to a considerable degree, organic disease should be suspected, and the suspicion will be confirmed if there is persistent alteration of sensibility, muscular wasting or altered irritability, or trophic changes in the skin. Great care is necessary, however, in testing the muscles, because a strong electrical stimulus may greatly increase the pain. The isolated faradic shocks should be employed rather than the current, because they cause much less pain, and because they detect most readily the earliest change produced by neuritis, a slight increase of irritability; an altered reaction to voltaism will also often be found. Early tenderness of the nerve, not merely during but between the paroxysms, extending some distance, and distinct swelling of the nerve, indicate neuritis. The absence of these does not exclude neuritis, because it may occupy an inaccessible portion of the nerve. If the symptoms of structural damage gradually increase and progress, and especially if they involve the whole region of the distribution of the nerve, compression may be suspected, and is confirmed by the discovery of any other symptoms indicating organic disease in the vicinity of the nerve trunk, such as, in the case of the fifth, damage to other nerves which arise or pass near it. It must be remembered that in some cases the differential diagnosis of slight inaccessible neuritis from neuralgia may be impossible, because, on the one hand, the irritation of neuritis may cause neuralgic changes in the nerve centre, and, on the other, a primary functional neuralgia may cause, by reflex vaso-motor disturbance, secondary changes in the sheath, so that in each case a mixed affection, partly functional, partly organic, is the result; or, in current terms, a neuralgia which is at first either symptomatic or idiopathic, may ultimately be both.

In all forms of neuralgia, the circumstance that the patient has previously had attacks of pain in other situation is a very important help in diagnosis. It does not, of course, prove that a given pain is of functional origin, but it is proof of a ten-

dency to such pain, which may justly be allowed considerable weight in the absence of signs of an organic lesion. This character is frequently of very great practical value, especially in cases of neuralgic pain of unusual seat. Another similar indication is the fact that the neuralgia replaces some other functional disease, as, for instance, migraine.

Special Diagnosis.—Their are certain affections with which the several varieties of neuralgia are liable to be confounded. Almost any form of neuralgia may be simulated by the pains of tabes, and the possibility of this cause should always be thought of, especially in the case of migratory pain. In some situations the risk of error is greater than in others, and these will be especially mentioned.

In neuralgias in the branches which are distributed over the skull (fifth and great occipital) it is often doubtful whether the affection should be called headache or neuralgia. The distinction in some cases is one of name rather than of real difference. Either term is employed, according as the pain seems superficial or deeply seated. But the fifth nerve gives fibres to the dura mater, and it is probable that some of the deeply-seated unilateral headaches are really allied to neuralgia, although it is customary, on account of their special association, to describe them separately. The fifth nerve is often damaged by organic intracranial disease, and nerve pain, thus produced, is sometimes mistaken for simple neuralgia. Besides the indications already described, organic disease often causes deeply-seated headache and other symptoms, especially in the functions of other nerves, optic neuritis, and paralysis or convulsion in the limbs. A history of recent syphilis increases the probability of organic disease, but does not render it certain. The occurrence of herpes in the course of a supposed neuralgia is also probable evidence, here as elsewhere, of organic changes in the nerves. It must not be forgotten that neuralgic pains are sometimes the first symptom of morbid growths in the upper jaw and parotid region.

The diagnosis of the cervico-occipital form rarely presents any difficulty. The neuralgic pain usually courses along the nerve trunk, but it must be remembered that occipital neuralgia is occasionally bilateral. In caries of the cervical vertebrae pain may be an early symptom, but it scarcely ever spreads to the occiput, and the early interference with movement is usually characteristic.

The neuralgias of the arm have to be distinguished chiefly from neuritis, by the indications already mentioned. The diagnosis is seldom difficult, because neuritis usually causes trophic changes in the muscles and skin, and the nerves are accessible in a large part of their course.

A more difficult problem is presented by the trunk neuralgias, which have to be distinguished from disease of the internal viscera, and from organic spinal disease. Unilateral pain is a frequent accompaniment of disease of the organs in the thorax and abdomen, and it is hardly necessary to point out that, in every case, a careful examination should be made of the organs adjacent to the seat of pain. The greatest difficulty arises in the case of deeply-seated tumors which cause pain by nerve compression, especially when, as is sometimes the case, the pains are "reflected" and do not precisely correspond in position to their cause. Aneurism of the aorta, for example, often gives rise to such pain, especially when seated in the descending part; pain in the course of the nerves may be the only symptom until sudden death occurs. The pain is usually very severe, and often burning in character, and has not the same foci of intensity and tender points as in ordinary neuralgia. In severe unilateral (and even bilateral) pain, persistent in occurrence, whether uniform in seat or not, this cause should always be suspected. One of the most severe cases of neuralgic pain I have ever seen—darting, stabbing, burning, migratory pains in legs, abdomen, thorax, and left arm—was due to an undiscovered abdominal aneurism. Aneurism of the ascending part of the arch is now and then accompanied by pain passing to the arm, apparently of reflex character. Intercosto-humeral neuralgia may simulate angina pectoris, of which indeed, such neuralgia may be said to form part. The severity of the paroxysms of angina, and the other distressing sensations which accompany the pain, usually render the nature of the attacks sufficiently clear.

The parietal pains which accompany disease of the spinal cord rarely have the acute lancinating character of neuralgia; they are sensations of tightness or constriction, and the obtrusive symptoms in the legs indicate the nature of the disease. To this, however, morbid growths of the cord offer an exception, especially in the early stage. The pains may be very severe and of various character, but they are constant

in seat, are increased by any movement, and, before long, indications of compression of the cord are added to them. The "lightning pains" of tabes are sometimes felt in the trunk, and have often been mistaken for neuralgia. They are distinguished by their changing seat and momentary duration, by the similar pains in the legs, and especially by diminished sensibility over extensive areas. In most cases there are some pains in the legs and the knee jerk is lost, but I have seen one case in which the changes were confined to the dorsal region of the cord and the knee jerk was normal, but in this, as in other cases of the kind, the light reflex of the iris was lost, a symptom of great indirect diagnostic importance. More constant in seat and neuralgic in character are the pains of pachymeningitis, which are caused by the compression of the nerve roots by the thickened membranes. They are distinguished from neuralgia by the wide extent of the pains, their bilateral situation, by the presence of areas of anæsthesia due to still greater damage to the nerves, by muscular wasting in the limbs, and by the symptoms of compression of the cord.

The terrible nerve pain which is sometimes produced by organic disease of the bone of the spinal column closely resembles neuralgia in its fixity of site and unilateral situation, but is distinguished by its peculiar dependence on movement of the trunk. Leg symptoms are usually soon associated with it. The lumbo-abdominal neuralgia may be confounded with renal colic. The distinction rests chiefly on the urinary symptoms that accompany the latter.

The sharp pains of tabes are more frequently felt in the legs than in the trunk, and these also are often mistaken for neuralgia, but the indications already mentioned suffice to distinguish them. The distinction of sciatic neuralgia from neuritis must be made by the indications. Of still greater practical importance is the distinction of crural and sciatic neuralgia from the pains due to pressure on the lumbar and sacral plexus by tumors in the pelvis and abdomen. Such pains are felt along the course of the nerves, and are almost invariably thought at first to be neuralgic. Pains in the front of the thigh are rare except as the result of extension of neuritis from the sciatic nerve to the lumbar plexus, or as the result of pressure. In each case there is generally muscular wasting, which shows organic damage. The diagnosis be-

tween neuralgia in the front of the thigh and pain due to a lesion of the nerves, is also aided by the state of the knee jerk, which is generally early lost in organic disease, but remains intact in neuralgia. In every case of neuralgic pain in this situation, the abdomen should be carefully examined, and whenever pain in the sciatic is of a progressive character, and apparently due to mischief above the accessible part of the nerve, a rectal examination should be made, by which the source of pressure, if there be any, will readily be felt. It must also be remembered that pain felt in the knee may be a reflex effect of the irritation of the branches of the obturator nerve in hip-joint disease, and that obscure pains in the groin and thighs are sometimes the result of disease of the femur. (In one case of intense stabbing pains in the groin, closely resembling neuralgia, the cause was ultimately found to be necrosis of the great trochanter.)

The diagnosis of the spinal forms of neuralgia need not detain us long. In the reflex or sympathetic variety the cause of the pain will usually be discovered, if it is remembered that it may be outside the area in which pain is felt. It is rarely far distant; often in another branch of the same nerve. Pain in any part of the fifth nerve, for instance, may be due to the irritation of a carious tooth.

It is possible to confound epileptiform neuralgia with the form of true epilepsy in which the aura is a sudden pain. I have known, for example, slight attacks of minor epilepsy to be preceded by a most severe momentary pain in one fifth nerve. The occurrence of distinct loss of consciousness, and still more of convulsion, sufficiently indicate the epileptic nature of the case. A painful epileptic aura in a limb, followed by local convulsion, could only be mistaken for neuralgia with reflex spasm, in a patient who had never had a severe fit. But the course of such an aura is usually centripetal and deliberate, and the spasm has also a deliberate march.

Prognosis.—The prognosis in neuralgia is influenced by the age of the patient, by the duration of the affection, its situation, severity, and cause. It is far better when the disease is due to any constitutional condition than when no general cause can be discovered, since, as a rule, the constitutional states that cause neuralgia are amenable to treatment, at any rate in such a degree as to influence the pain. In hysteria,

however, some neuralgias are readily removed; others, especially when there is no anæmia, are most obstinate. The prognosis is better when there is no hereditary tendency than when this is marked. We do not yet know whether the prognosis is influenced by the fact that the heredity is general or special. The more severe the pain, and the longer the disease has lasted, the more difficult is its treatment. It is generally believed that neuralgias of the fifth nerve are more intractable than others. During the decline of life, neuralgias of all kinds, especially those of the degenerative form, are peculiarly obstinate, and in old age they sometimes cannot be relieved by any treatment whatever. However severe the pain may be, neuralgia involves little danger to life; as Buzzard has well said, "the disease does not seem, of itself, to shorten the duration of the life which it fills with suffering." Epileptiform neuralgia is, of all forms, the most obstinate; Trousseau, in his large experience, never knew a case to be cured. When neuralgia has once ceased it is extremely prone to recur, and this fact, which is true of all varieties, must be remembered in giving an opinion regarding the future.

Treatment.—The treatment of neuralgia consists, first, in the relief of the symptom, pain, and, secondly, in the removal of its cause, *i.e.*, in the restoration of normal conditions of function in the sensory apparatus. The means by which these ends are to be secured are threefold—by hygiene, by drugs, given internally and applied externally, and by certain surgical operations on the nerves. It is evident that the treatment to be adopted must be influenced, to some extent, by the nature of the case. When there is distinct evidence of neuritis, the treatment for this, already described, must be adopted. The treatment now to be considered is that of the "idiopathic" form, but the means for the alleviation of all forms is nearly the same.

Although the relief of pain has usually to be the first actual step in treatment, the first in importance is the removal of the causes of the disease. Any discoverable condition on which the neuralgia may depend must be treated. The detailed measures that are necessary need not here be indicated, since they are sufficiently suggested by the enumeration of the causes and causal varieties already given. Especially should any source of nerve irritation be removed, whether in the

region of the painful nerve or outside it. It must be remembered, however, that it is not certain that the neuralgia will disappear on the removal of such a source of irritation. This is especially true of neuralgias of the fifth nerve and decayed teeth. The almost universal association of neuralgia with conditions of debility, so strongly insisted on by the late Dr. Anstie, indicates the importance of hygienic measures calculated to improve the general health; fresh air, adequate rest, and nutritious food in full quantity, and a small quantity of alcohol at meals is usually directly beneficial. The importance of a good supply of animal food should be urged, for all but gouty subjects. I have known severe neuralgia to occur first on the patient commencing a purely vegetable diet, to disappear when meat was taken, and recur with severity at each of four successive attempts to return to vegetarianism. Cod-liver oil, or other easily digested fat, may often be added with advantage. Iron, when there is anæmia, will sometimes alone cure the disease, and even when there is no anæmia it seems occasionally to be beneficial. Of nervine tonics, quinine is of most value in true malarial forms, given in a full dose shortly before a periodical attack is due; but, as we have seen, it is not always successful. In smaller doses it is occasionally useful in other forms, although not so frequently as might be expected from its marked influence on the nervous system. In stupefying doses it may lessen the pain for a time, but does not often produce a lasting effect. It has been thought to be most useful in neuralgias of the first division of the fifth nerve. Nux vomica or strychnine often does more good than quinine. In general, it may be said that whenever the nervous system is feeble, as it so frequently is in neuralgia, nux vomica may with advantage be added to the other remedies that are given. Zinc (including the phosphide) is of little value. Arsenic is occasionally useful, especially in the neuralgias that have been set up by malarial poisoning, and in the degenerative variety. Free phosphorus ($\frac{1}{30}$ or $\frac{1}{30}$ grain) has been strongly recommended, but my experience coincides with that of most recent writers in assigning it a very low position in the list of remedies—low so far as numerical success is concerned, although in rare cases its influence is very striking. For instance, a woman, aged forty-three, with neuralgia of the fifth nerve of thirteen years' duration, at one time associated with brachial,

and afterward with crural neuralgia, lost the pain entirely during three months' treatment with phosphorus, although when the treatment was commenced about twelve severe paroxysms occurred every day. Ammonio-sulphate of copper has been recommended in cases of neuralgia of the fifth nerve. It may be given in doses of $\frac{1}{16}$ or $\frac{1}{12}$ of a grain after food. In syphilitic forms, dependent on actual nerve lesions, iodide of potassium is now and then useful in cases of neuralgia that are not due to syphilis.

Of remedies that have a sedative action on the nervous system, although they are not anodynes, the most important is bromide of potassium. It is occasionally of service in cases of idiopathic neuralgia, paroxysmal in occurrence, although it appears to have less influence on sensory than on motor nerve cells. Its value is greatest in irritable, anxious subjects. Chloride of ammonium has been recommended in intercostal neuralgia. In the rheumatic forms, salicylate of soda has been occasionally found useful, especially in facial neuralgia and sciatica, but in the cases of sciatica which depend on neuritis it has little influence.

Nervine stimulants given at the beginning of an attack occasionally cut it short, especially in neuralgias of the fifth nerve. The most effective are sulphuric ether, valerian, and alcohol. The use of alcohol to relieve pain is, however, fraught with great danger to the habits of the patient, and should be avoided as far as possible. Another nervine stimulant, turpentine, is an old remedy for sciatica, and has been occasionally employed with cases of ordinary neuralgia. Nitroglycerin is sometimes useful for the same purpose, and, as a rule, it succeeds whenever alcohol is effective. It is also extremely valuable in many cases, given regularly three times a day in doses from $\frac{1}{200}$ to $\frac{1}{50}$ of a grain. It is most useful, as in migraine, when the face gets pale at the onset of an attack, but sometimes succeeds when this indication is wanting, although very rarely when flushing is an early symptom.

Anodynes are necessarily very important elements in the treatment of neuralgia. It is the pain for which the patient seeks help; the cause of the pain can only be slowly influenced, and in the mean time the pain itself has to be relieved. In some cases relief is all that can be afforded; treatment fails to

prevent the recurrence of pain, and all that can be done is to lessen its intensity. But in a large number of cases of neuralgia anodynes do more than merely palliate; the repeated removal of the pain tends to prevent its recurrence. This makes it probable that the relief afforded is not merely by an action of the drug on the general sensorium, but that it has an influence on the specific disturbance which gives rise to the sensation of pain. The same conclusion is suggested by the fact that most acute pain may be entirely relieved by an anodyne which has no apparent influence on the general sensory functions of the brain.

No drug gives relief so quickly and so surely as opium or morphia. The hypodermic injection of the latter has to a large extent replaced its administration by the mouth, on account of the rapidity of its action and the slighter degree of gastric and intestinal disturbance which it causes. In epileptiform neuralgia Trousseau found no remedy comparable to opium, which he gave in doses rapidly increasing up to 300 grains of opium or sixty grains of sulphate of morphia a day. Morphia beneath the skin may be given in all forms of neuralgia. It is probable that in most cases it is better to inject it into the seat of pain, because it can then exert some influence on the terminal nerve endings, and, moreover, the injection has a slight counter-irritant influence. But its chief action is on the centre, and this is exerted equally wherever the injection is made; therefore, if, for any reason, local injection is undesirable, a distant convenient region, as the back of the forearm, will answer almost as well.

The dose of morphia should not at first be large, one-tenth, one-eighth, or one-sixth of a grain, according to the severity of the pain. It is unsafe to commence with a large quantity; death has in more than one instance resulted from an injection of one-fourth of a grain, and, still more frequently, alarming symptoms have been produced. It is remarkable, however, in some cases of neuralgia, how little effect beyond the relief of the pain morphia produces. The addition of atropine (in amount about one-twentieth of the morphia used) will often prevent nausea and giddiness and increase the influence of the drug. Caution should be used to prevent the dangerous "morphinism," most cases of which have been set up by the use of this drug for the relief of neuralgia. The hypodermic

syringe should never be placed in the hands of the patient. In cocaine, however, we have an agent that can often replace morphia. A local injection of from half a grain to a grain often gives great relief to the pain, apparently by arresting all impressions from the periphery, which may have a great influence in keeping up the morbid state of the centre, even in cases in which there is no peripheral irritation, and still more when there is. It has little or no central influence, and has, therefore, less permanent effect than morphia. Repeated injection may, however, lead to recovery, if there is peripheral irritation, or a spontaneous tendency to the subsidence of the morbid process in the centre.

Belladonna may be given by the mouth (one-sixth to one-third of a grain of the extract), or atropine by the skin ($\frac{1}{120}$ to $\frac{1}{60}$ of a grain). Occasionally these give marked relief to the pain, and when this is the case they are said to produce a more permanent effect than morphia (Hunter, Anstie, Vainclair). The unpleasant dryness of the throat which is produced by full doses sometimes constitutes a difficulty in the use of these drugs. It is often convenient to alternate injections of atropine with those of morphia in cases in which there is danger of the establishment of the morphia habit.

Aconite and gelsemium are said to have a special action on the fifth nerve, and are frequently useful in trigeminal neuralgias. Aconite is the more powerful of the two, but often causes nausea and unpleasant symptoms. In slight cases, especially those which depend on dental caries, gelsemium is often useful; fifteen minims of the tincture may be frequently repeated. Aconitia may also be given in doses of $\frac{1}{250}$ to $\frac{1}{100}$ of a grain, but it is a somewhat dangerous remedy to employ hypodermically. The alkaloid of gelsemium (gelsemia), will also be found useful for subcutaneous use; the dose is $\frac{1}{60}$ to $\frac{1}{30}$ of a grain. Cimicifuga is often very useful for neuralgia associated with rheumatism, either alone or combined with Indian hemp. In gouty subjects, lithia may also be given with advantage combined with cimicifuga.

Indian hemp is another remedy of great value in certain forms of neuralgia, especially those in which the pains are sudden, brief, and sharp, without the violence which marks true epileptiform neuralgia. It is often very useful continuously administered between the intervals; a quarter to half

or even one grain three times a day. *Piscidia erythrina* has been recommended when pain is not severe; in moderate doses (ʒ ss. of the liquid extract) it leaves no unpleasant after-effects. Chloral has little influence over pain, but croton-chloral (butyl-chloral) is sometimes useful, especially in neuralgias of the fifth. It is usually given in doses of five grains, but, as Ringer and others have shown, the dose may often be increased (up to twenty grains) with advantage. Combinations of nerve tonics and sedatives are generally necessary, but as the sedative has to be continuously given, its dose must, of course, be moderate. I have found, for instance, in neuralgia of the fifth, the combination of arsenic, quinine, and Indian hemp of great service.

Neuralgic pain is often relieved by local treatment, which is, for the most part, of two kinds, irritant and sedative; and some remedies combine the two. Counter-irritation sometimes gives great relief to neuralgia, but the mode in which it acts is uncertain. Hypothetically, it acts through the vessels, but this influence is more intelligible in neuritis than in neuralgia. It may also exert an inhibitory influence, or may change the mode of action of the nerve centre; just as a blister around the limb will stop the aura of epilepsy. Either blisters, or sinapisms, or the actual cautery may be employed. Flying blisters may be applied over the tender spots, or by the side of the spine. Anstie believed that the latter yield the best results. Chloroform has been injected beneath the skin, fifteen or thirty minims, but, although it often gives some relief, it may cause a troublesome slough. In trigeminal neuralgia the blister may be applied beneath the occiput or behind the ear. The actual cautery is of most service in spinal neuralgias. The gas cautery, or galvanic wire, or thermic hammer is the form generally used. The local injection of carbolic acid or of osmic acid has lately been recommended; they have been employed chiefly in trigeminal neuralgia and in sciatica. (Mercer, "*Lancet*," 1885, No. 2; Jacoby, "*Trans. Am. Neurolog. Ass.*," 1885, p. 11; Schapiro, "*Petersburg Med. Wochenschrift*," 1885.) One or two drops of a one-per-cent solution of osmic acid (in water and glycerin) have been injected at a time. It is said to give immediate relief to the pain; some cases are reported as being cured after about a dozen injections. It does not appear to be entirely free from

danger; Jacoby observed palsy of the radial nerve to follow an injection into the arm, as it occasionally follows an injection of ether.

Acupuncture, the introduction of needles into the painful part, is a method introduced from China and Japan, the value of which is not great. If, as in the East, the needles are left in for some hours or a day, they cause much pain. Aquapuncture has also been employed; it consists in the injection of pure water into or beneath the skin. Originally, it was introduced into the skin, or between the true skin and the epidermis, under considerable pressure, so as to force the water to separate the tissues and make spaces for itself. This method gives much pain and does little good. The injection of water beneath the skin is innocuous and occasionally relieves a slight pain.

Of external applications that are at once irritant and sedative chloroform is the most important, pure, or as the *linimentum chloroformi* (B.P.), or a dilution of one part of chloroform to six of *lin. saponis*. Next in value are the ointments of *veratria* and *aconitia*. They should be rubbed in until tingling is produced, followed by numbness. The milder tincture of aconite may also be painted on the part two or three times a day, avoiding any sores. Camphor-chloral (camphor and chloral rubbed up together in equal parts, so as to liquefy) may also be applied on lint covered with oil silk. Both this and chloral will blister if left on too long. Menthol is also a useful application to the skin in the slighter forms of neuralgia. It causes a singular sensation of tingling and coldness, and for the time lessens the pain. It may be employed pure in the solid form, or rubbed up with chloral, or with spirit or glycerin. Preparations of opium (usually oleate of morphia) are of very little value as external applications. Belladonna is of greater service if employed sufficiently strong; the extract, diluted with one, two, or three parts of glycerin or vaselin, may be smeared over the skin two or three times a day. The oleate of atropia (five-per-cent solution in oil) may be used in the same way. Lanolin has been lately introduced as a better vehicle for external sedatives. These local applications apparently act by lessening the ordinary stimuli which pass along the nerves to the centre, and some of these agents substitute for the ordinary stimulation

a different form, which apparently lessens instead of increasing the morbid action of the centre.

Among external applications that of simple cold or warmth should be mentioned. Each occasionally gives temporary relief if applied continuously to the seat of the pain. In most cases heat is the safer and more effectual. Considerable heat is often little felt at the focus of most intense pain. If there is the least suspicion of active neuritis heat must be applied to the distribution of the nerve with extreme caution, or disastrous consequences may ensue. A warm douche through the nose has been strongly recommended by Seeligmüller in cases of supra-orbital pain, supposed to be produced in the frontal sinuses even when of malarial origin. Ether spray to the spine has also been recommended in various forms of neuralgia. Cold to the painful part is rarely useful, except in the case of neuralgia of the testes, where refrigeration can be more completely effected than elsewhere.

Electricity, properly employed, is an agent of considerable value in the treatment of neuralgia. It may be used in two ways: (1) A strong current, causing, for the time, considerable pain, will occasionally remove the neuralgia at once, no doubt by altering the form of central action, just as does a counter-irritant. The effect is probably only produced in cases of idiopathic neuralgia of slight degree. In some cases of this class, and invariably in neuritis, a strong application renders the pain worse, and the risk of this effect must be borne in mind. The forms in which it is most likely to be successful are recent cases of hysterical neuralgia, especially when the pain is seated in the joints. To produce this energeting effect either faradism or voltaism may be used. (2) A weak current may be used for its sedative action on the nerves. Either form of electricity may be employed, but the action of the two is essentially different. The voltaic current is the most frequently useful. Authorities are divided on the best method of applying it, but the majority are of opinion (and with this my own experience agrees), that it is best to neglect the direction of the current, and to place the positive pole near the seat of the pain, and the negative in some indifferent situation. If there is reason to believe that the neuralgia is central, the positive pole may be placed, during part of the application, as near as may be to the central termination of the nerve,

and, for another part of the time, on the seat of the pain. The strength should be from two or five milliampères, but if the battery is not provided with a galvanometer, the number of cells must be regulated according to its effect on the sensory nerves, so as to cause a slight tingling or burning sensation, not actual pain. The number of cells to be used will vary in different parts, chiefly in consequence of the varying sensibility and resistance of the skin. The patient's sensations are, indeed, often the best guide. For the face, three, and elsewhere, five cells may be employed to begin with, and the current gradually increased until it can just be felt. All sudden variations in strength should be avoided. A well-wetted sponge should be employed as the electrode, and this should be very gently and gradually applied, and very gently removed when the strength is altered. If the faradaic current is employed as a sedative, it must be extremely weak (so as to be just felt, but to occasion no pain) and rapidly interrupted. The rapidly recurring slight stimulation of the nerves produces after a time a sedative effect, at first slightly increasing, but after a few minutes distinctly relieving, the pain. Its action is analogous to, and quite as effectual as, the mechanical percussors recently introduced.

The surgical treatment of neuralgia comprehends the division, excision, and stretching of nerves, and the ligature of arteries. It is a very large subject, and for detailed particulars the reader is referred to works on surgery. Neurotomy has been frequently adopted in cases of severe, old-standing neuralgia, especially in the branches of the fifth nerve. Sometimes it is successful, more often it fails. Temporary relief may be given, and may continue for some months, but is too often succeeded by a return of the pain in all its old severity. This has been ascribed to the union of the divided ends, and to prevent this the excision of a certain length of the nerve, or the deviation of the extremities has been recommended. In cases of neuralgia of the second division of the fifth, the excision of Meckel's ganglion has sometimes given better results than simple division of the nerve. (See a paper by Dr. Chavasse, of Birmingham [Royal Medical and Chirurgical Society, meeting of Feb. 20th, 1884, and discussion thereon]). It is probable, however, that the transient relief is often due to the influence of the surgical irritation on the centre, which soon

passes off. (Neuralgia will sometimes disappear for a time under strong mental influence. Le Fort, for instance, mentions that a most obstinate lingual neuralgia ceased during the siege of Paris, and returned when the anxious time was over.) In central neuralgia, or organic lesions high up the nerve (as, for instance, in the post-herpetic form), the operation usually fails. It is only to be thought of in cases in which other means have been fairly tried without success, and in which all the branches to which the pain is referred can be divided; it is said that the operation is more likely to be successful if pressure on the nerve relieves the pain. The operation is inadmissible if the nerve is one paralysis of which involves grave consequences, as, for instance, in the case of the sciatic, division of which causes permanent palsy and atrophy of a large part of the leg. These consequences might be deliberately chosen if it were certain that the pain would be exchanged for them, but, unfortunately, relief is too uncertain to make it justifiable to run the risk of adding physical disability to undiminished suffering. The same consideration (and the fact that it can do no more than neurotomy) precludes amputation, except, perhaps, in rare cases in which the pain starts from the extremity of a finger or toe, and local tenderness, etc., make it probable that a cause of nerve irritation exists. (It has been proposed to tear the nerve in two, by making traction on the central portion. The alleged advantage is that the nerve separates nearer the centre than it can be divided. But it always tears within a centimetre of the place where it is seized; the advantage is probably imaginary, and the method is not without danger [see a discussion at the Paris Société de Chirurgie, Dec. 6th, 1882]).

Fortunately, in nerve stretching we have an operation which produces some of the effects of neurotomy, arresting for a time the conducting function, and effecting what may be called an alterative stimulation of the nerve. Its influence is less lasting, but so are also its inconvenient effects, and, as it is sometimes successful, it should generally precede division of the nerve. It has been recommended that strong traction should be made on the central end, but it is doubtful whether this has much influence, and, in the case of the fifth nerve, it is somewhat perilous. (There is evidence that too vigorous stretching of the second division of the fifth nerve has caused

destructive inflammation of the eyeball, probably by the mechanism of inflammation of the Gasserian ganglion [Nicaise and Tillaux, *Soc. Clin. de Paris*, March 9th, 1882]). Recent literature abounds with records of cases of apparent cure from nerve stretching, even when the neuralgia seemed to be central. For instance, a severe intercostal neuralgia of twenty years' duration is said to have been cured by stretching the terminal branches of two or three of the nerves (Nussbaum, "*Aerzt. Int.-Bl.*," 1878, No. 53). Intensely severe neuralgia of the third division of the fifth—the pain being in the ear, temple, lower jaw, and tongue—of five years' duration, is said to have been cured by a single stretching of the lingual nerve in the tongue (Le Dentu, "*L'Un. Méd.*," 1881, vol. II., p. 766). In this and many other cases the pain did not immediately cease, but gradually subsided in the course of one or two weeks. In some rare cases, in which the sheath of an accessible nerve can be felt to be greatly thickened, the nerve has been exposed, the sheath opened carefully, and the nerve for some distance separated from it. This operation has been successful in arresting the pain, especially in traumatic cases. (An instance is recorded by Le Fort, "*Soc. de Chir.*," July 26th, 1882, in which the median was surrounded by a dense sheath of connective tissue, due to inflammation produced by a gunshot wound.)

Ligature of arteries has been confined to that of the carotid, as a last resort in cases of neuralgia of the fifth nerve. All that can be said to justify so dangerous an operation is that it has sometimes, but very rarely, been successful. Compression of the carotid occasionally cuts short an attack of pain, and the repetition of this treatment, continued for a long time, has even produced permanent alleviation.

An attempt to estimate the true position of the surgical treatment of neuralgia is unfortunately beset with almost insurmountable difficulties, due to the fact that after many operations the pain has ceased, or been much lessened, for a time, but has afterward returned, and the cases have been published before sufficient time has elapsed to permit an opinion to be formed of the permanence of the effect. Moreover, the numerous cases in which there has not been even temporary relief are seldom published. In some instances, operation after operation has been submitted to by the patient under the urgent

compulsion of continued suffering, and the records of many cases illustrate very strikingly the need for caution in drawing any inferences from transient relief. (The following cases are illustrations of this. In one instance, a man, at the age of forty-five, had his first attack of neuralgia in the third division of the fifth nerve. Four teeth were extracted from the lower jaw and then one from the upper, and, as the pain ceased for three weeks, the case was published as cured. The pain returning, resection of the alveolar process was performed; the pain ceased for five months, and the case was again published as cured. After a relapse, the inferior alveolar nerve was excised, and freedom for some time was followed by a return, for which the carotid artery was tied, but the effect of even this was not permanent [J. C. Hutchinson, "Am. Med. News," 1885, p. 395]. The same author relates a case of neuralgia of the fifth, in which the following operations were performed without success: an incision through the skin above the ear, division of the supra-orbital and infra-orbital nerves, excision of half an inch of the supra-orbital, ligature of the carotid, destruction of the nerve in the infra-orbital canal. In a case, recorded by Schupper, of neuralgia of the fifth with reflex spasm in the face, the first procedure was scarification of the outer and inner surfaces of the upper jaw; this failing, the surgeon excised the infra-orbital nerve; this likewise failing, he excised the superior maxillary nerve in the spheno-maxillary fossa; there being no relief, he removed the peripheral segment of the same nerve from the base of the orbit. The pain then migrated to the third division of the fifth; the inferior maxillary nerve was therefore excised. An interval of freedom was followed by a return of the pain, and the common carotid was tied. The pain continuing, the facial nerve was divided, and on account of severe hemorrhage, the external carotid and temporal arteries were tied, and the patient is said, at last, to have been "cured.")

VISCERAL NEURALGIAS.

The internal viscera of the thorax and abdomen are sometimes the seat of neuralgic pain. Such neuralgias are described in full in the works that deal with the diseases of these organs, and this arrangement is convenient, since the princi-

ples of diagnosis involve a differential discussion of the symptoms of organic diseases of these organs which would be out of place in the present work. A brief outline of the general facts may, however, be given here.

Most of the organs in which these neuralgias are felt receive their chief nervous supply from the sympathetic system. Little sensation attends their normal function. Although it cannot be doubted that afferent impressions are constantly passing to the cerebro-spinal centres, these fail to affect consciousness under normal circumstances. But repeated attention may vastly increase the sensitiveness of the perceptive centres to such impressions, and from such increase arises a large amount of the discomfort of those patients who are termed "hypochondriacs"—correctly, in so far as the organs which lie below the rib-cartilages disturb their conscious life. But the sensation from the viscera may also amount to actual pain, in consequence of the afferent impressions being abnormal, owing to organic disease and varied functional disturbance. Pain may also be felt apart from either of these causes, and such pain is called "visceral neuralgia." Often we cannot tell to what extent it is the result of a local abnormal condition of the nerves of the organs, and how far it is central. It is probably local in causation to a larger extent than in the case of the cerebro-spinal forms of neuralgia, but the same general pathological laws doubtless underlie the two. The difficulty of investigation depends not only on the fact that the organs are concealed from direct examination, but also on the circumstance that they receive their innervation from two sources, from the sympathetic, and from the cerebro-spinal centre by the pneumogastric and spinal branches, and we do not know what share these sets of nerves respectively take in the production of visceral pain. There is, moreover, reason to believe that not only the nerves in the viscera but also the nervous plexuses outside them may be the seat of neuralgia. The difficulties of investigation are greatly increased by the fact that pain may be the only symptom of organic and of functional disease, and it is certain that many examples of such disease have been included among the visceral neuralgias by some writers on the subject.

Most forms of visceral neuralgia are more frequent in females than in males, and may be produced by the same in-

herited tendency that causes the cerebro-spinal forms. Their general causes are also, for the most part, similar. In women, anæmia and hysteria are especially prominent. They may also result from causes that have a local action, and this fact adds not a little to the obscurity of their diagnosis. The essential symptom is pain, which varies greatly in character, sometimes dull and diffuse, sometimes sharp, circumscribed, lancinating or burning. It usually presents paroxysmal exacerbations, and is sometimes actually intermitting. I have known paroxysms of gastric pain to alternate with headache. The exacerbations may be apparently spontaneous, or may be produced by various stimuli, especially by those concerned in the functional activity of the organ. We ought not, however, to include among the neuralgias (as some have done), cases in which pain is confined to periods of functional activity. It is doubtful whether, in such cases, the affection is ever a pure neuralgia.

The diagnosis of visceral neuralgias is as difficult as it is important. Pain is the common, and may be the only, expression of various and very different maladies. The first and chief element in diagnosis is the exclusion of organic disease, by every method of investigation that can be made available. If functional disturbance exists, the affection can only be regarded as neuralgic when the pain is not related to the disturbance of function either in time or in degree.

The treatment of visceral neuralgias must be based on the same general principles as that of the cerebro-spinal forms. It consists in the removal of causes, general tonic treatment, abundant rest, and the use of sedatives. The mode of employment of the latter differs in each case, and in each, also, special measures are necessary, related to the function of the organ concerned.

Special Forms.—Of the intra-thoracic organs, the lungs do not appear to be the seat of neuralgia, although the pain of “pleurodynia,” already described, is probably due to an affection of the pleural nerves. The only important cardiac affection of this class is the disease known as “angina pectoris.” Severe nerve pain is a prominent symptom of the disorder, but its peculiar and special characters and associations prevent its inclusion among the forms of pure neuralgia.

The most important visceral neuralgias are those of the

abdominal organs. They are usually local and well-defined, but occasionally abdominal neuralgic pain varies in its seat, and is felt now on one side, now on another. That of the stomach (gastralgia, gastrodynia) is one of the best-marked forms. It is frequent in anæmia and hysteria, and a special form constitutes the gastric crises of ataxy. The pain is felt at the epigastric region, and, like most gastric pains, passes through to the back. Pressure does not usually increase it, often, indeed, it relieves the more intense suffering. There is usually a constant dull pain, with more acute exacerbations. It may be most intense when the stomach is empty, and may be relieved by food; it is then possibly due to the morbid action of the nerves or centres from which, in health, the sensation of hunger arises. Or the pain may be increased by food, and in such cases food is often vomited as soon as it is taken. Appetite may be absent, lessened, increased, or perverted. The relation of the condition of appetite to the effect of food in relieving or increasing the pain deserves further study.

The stomach is readily influenced by sedatives, and their administration by the mouth forms an important part of the treatment. Other agents are sometimes useful. In the form that is relieved by food, oxide of silver is often of great service. When there is anæmia, the combination of subcarbonate of bismuth and saccharated carbonate of iron, given before food, is frequently effective. No sedative, however, is on the whole so useful as cocaine, of which a grain may be given when the pain comes on. By repeatedly relieving the pain in this manner, the disease is often cured, apparently by the rest thus given to the nerves of the mucous membrane.

The frequency of intestinal neuralgia (enteralgia) has probably been exaggerated. We are not justified in regarding as enteralgia either vague abdominal pains, which are not increased by peristaltic action, or pain that occurs only when the intestines are in energetic action, or in which there is conspicuous disturbance of the mucous membrane. If these are excluded, the cases of enteralgia become extremely rare, and the history of the affection has yet to be worked out. There is, however, one part of the intestine which is, undoubtedly, the seat of neuralgic pain—the lower part of the rectum. This form occurs in both sexes, as a deeply-seated pain above the

anus and coccyx, more or less constant, but with severe exacerbations, apparently due to spasm. It is usually effectually relieved by suppositories. In some cases, indeed, it is probably a primary spasm, and I have known it produced in a child by the use of senna as an aperient.

Of neuralgia of the liver, hepatalgia, much the same may be said as of enteralgia. Deep-seated pain is occasionally felt in the position of the organ, sometimes diffuse and dull, sometimes sharp and lancinating, but the cases in which we can be sure that it is truly neuralgic are extremely few. In some cases such pain may be due to disturbed function of the organ. Disturbance of function has been regarded by some writers as a consequence of neuralgia. It cannot be denied that such nerve pain may cause such reflex derangement of function, just as it causes vaso-motor disturbance in other situations. But the frequency with which pain is the first evidence of disease outside the nervous system, which afterward causes other symptoms, renders it necessary to exercise great caution in regarding such cases as primarily neuralgic.

The existence of neuralgia of the spleen is not well established, but occasionally, especially in cases of hysteria, there is deeply-seated pain and tenderness in the position of the organ, apparently situated in it or in the nerve plexuses in its vicinity.

The kidney, and apparently the ureter, may be in rare cases the seat of the neuralgic crises of tabes, analogous to the more frequent gastric crises, but the occurrence of primary nephralgia is a still more rare event, and can hardly be regarded as proved. Many cases of supposed renal neuralgia have certainly been due to the passage of a calculus. I have, however, met with one case in which paroxysms of pain in the renal region, had occurred at times during forty years without any indication of a calculus, and it seemed on the whole probable that the pain was of nervous origin.

Neuralgic pain which cannot be referred to any organ is sometimes felt within the abdomen. Such pain is diffuse, varies in intensity, is not increased by pressure, and is not related in time to the functional activity of the organs, or in degree to their disturbance. It is generally central in position, but may be felt above or below the umbilicus, apparently seated in the sympathetic nerves, but has not such a relation to their plexuses as to permit definite localization.

The female generative organs are frequent seats of pain and tenderness. Tenderness in the region of the ovaries is extremely common in hysteria and conditions of nervous weakness; sometimes there is much spontaneous pain in this situation, deeply seated and aching or burning in character. This pain may exist when no evidence of organic change in the ovary can be detected, and appears then to be a pure neuralgia; but in most cases the tenderness is extensive, and exists in the vicinity of the ovary as well as in the organ itself, so that it is probably due, at least in part, to the abundant nerve plexuses with which the ovary is surrounded. The uterus is also the seat of spontaneous pain and of tenderness, apart from organic disease or of displacement. These symptoms may occur in the young and also in later life, even when the involution of the organ is complete. They are often associated with neuralgic pains elsewhere—in the ovaries, and especially in the spine, including the sacrum. By some writers the pains of menstruation, when no organic cause for them can be discovered, are regarded as neuralgic.

Of the male organs of generation, that which is most frequently the seat of neuralgic pain is the testicle, but even here such pain is comparatively rare. It is important to remember, however, that inflammations of the urinary passages are not uncommon causes of neuralgia seated in the adjacent cerebro-spinal nerves.

THE PROGNOSIS
OF
DISEASES OF THE HEART.

BY

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THE PROGNOSIS OF DISEASES OF THE HEART.

GENTLEMEN:—We have heard, in the course of time, quite a large number of papers in this society upon the subject of heart disease. You will remember the addresses of our present chairman, my honored friend, Dr. Fraentzel. I have also made several additions to the subject; likewise Drs. A. Fraenkel, Litten, Lewinsky, and others. However, those questions which are especially important in practice were not discussed hitherto, at least, in an exhaustive manner, and this may offer a proof that it is indeed quite difficult to enter in detail into these questions.

Among those questions in the domain of diseases of the heart which must especially interest the physician in his practice, belongs undoubtedly that of the prognosis which these diseases warrant. If under the term prognosis we understand not alone the question whether a definite lesion of the heart is curable or not, or whether a patient suffering from heart disease who consults us, is to be regarded as a curable patient or not, it appears to be an equally important, difficult, and extensive subject.

The prognosis of a definite disease, or a definite patient, then embraces everything that can be predicted with more or less probability with regard to the further course. Not alone whether a cure can be effected or not, but also whether, and how long, life can be maintained; what measure of well-being or of suffering; what measure of capability and enjoyment of life stands at the disposal of the patient; finally, what conditions and accidents disturb and aggravate the course of the disease; what conditions may make it run a more favorable

course. It is, then, the object of medical science to prevent, as far as possible, the disturbances and dangers, and to utilize the favorable influences (including drugs) at the proper time for the benefit of the patient. In such a sense, the prognosis includes the entire judgment of the physician with regard to the significance of the case. It presupposes the most accurate knowledge, both of the form of disease and of the special conditions of the patient. It is the real quintessence of his medical knowledge. It has often been asked: what is the most marked service of the physician, and by what can we most easily recognize a physician of note? Some have said, he is recognized by the diagnosis; others, and I am inclined to agree in their opinion, by the prognosis. In the end, however, the best physician will be recognized by his results, inasmuch as he who can aid the patient most, and in the most difficult cases, is undoubtedly the best physician. But this success is determined with the greatest difficulty, and can only be measured by an objective measure with equal difficulty. We are, therefore, justified in regarding the prognosis and correct judgment of a case of disease as the best criterion. As a matter of course, this cannot be separated from the other functions of the physician. When it is said in various quarters in literature, that prognosis is a part of the diagnosis, this is entirely correct, as it is a part of the recognition of the case of disease. But it is also a part of treatment, because it shows us where the dangers for the patient lie, and where we must apply the therapeutic lever.

I beg your indulgence in prefixing these general remarks, partly in order to make my own principles clear, but partly, also, to indicate that I regard the present moment as well fitted to bring such an important practical question into this assemblage for discussion. The special reason for me, resides in the fact that here in Berlin, especially since the time of L. Traube, the study of heart diseases has been pursued with special vigor. I may, therefore, hope that this assemblage will furnish rich additions to this subject, which will be fitted to complete my views. The second reason is the fact that at the present time the clinic of heart diseases is found, if not in a new epoch, at least, in a condition of promising progress. The advances in this field have been furnished, on the one hand, from the fact that our clinic has emancipated itself

from the purely physical direction, without underestimating it, and that we have secured a broader standpoint in the diagnosis and judgment of diseases of the heart. While former medicine, prior to the time of physical examination, had a proportionately slight knowledge of diseases of the heart, this knowledge flourished in an extremely luxuriant manner as the result of physical diagnosis. But this striking progress, and this imposing diagnostic knowledge led to one-sidedness in certain respects, in so far as it was over-estimated and regarded as almost the sole object of medical judgment. I may say that our clinic has won a proper standpoint, and that we utilize not alone physical diagnosis, but also the observation of all the local and general symptoms in the diagnosis and judgment of diseases of the heart. In addition, in the course of time, our knowledge has been completed by many forms of disease which had hitherto been little studied. Furthermore, it is a favorable circumstance that we have secured new points of departure in the treatment of diseases of the heart. I refer here less to medicinal treatment which has also been enriched, than to the dietetic and mechanical modes of treatment, which have been the subject of numerous discussions for some years (Oertel, Zander, Th. Schott). Without a doubt, we have thus received new and weighty stimuli in treatment, particularly from Oertel, which I acknowledge with so much more readiness, as they have also opened a further fruitful field to pharmacological medicinal treatment. It is demanded of these methods that they effect more than we have hitherto been able to effect in the treatment of diseases of the heart. It is true, however, that this demand has met with much opposition, and the difficulty of deciding upon therapeutic results has also manifested itself here. If we now attempt, from the present standpoint of experience, to present the prognosis of cardiac affections, we will be able at least to determine approximately to what limits our therapeutic efforts have gone, and we can determine whether, and where, we can exceed these limits by new measures and methods. At the same time, I am well aware of the difficulties of such a discussion, and must at the start crave your indulgence. The difficulty resides in the object as well as in the form of treatment. It is not easy to discuss the prognosis from a general standpoint. It would be easier to

investigate the prognosis of each individual disease, but in this way we would not obtain general results. Great difficulties also reside in the nature of the subject. Even if I would assume to possess more than the usual experience in this field on account of my clinical and consultation practice of many years, it is hardly possible to define with precision the boundaries of our knowledge and powers. These difficulties are increased by the fact that the study of the literature shows very few preliminary works on our special theme. I have found the majority of them in the English literature, and here, also, the practical side of English medicine is manifested. In the medical societies of London lectures and discussions on this subject have been held several times. Among others, I may mention Broadbent ("Prognosis in Heart Diseases," "Brit. Med. Journal," 1884). Excellent remarks are also found in the practical text-books of Williams, Walsh, and Bristow. About two years ago, Sir Andrew Clark read before the British Medical Association a notable paper, "More than 100 Cases of Diseases of the Heart which Lasted demonstrably more than Five Years without producing Grave Symptoms." This lecture has perhaps not been sufficiently noticed in the German reviewing journals. Dr. Litten has furnished a very excellent review in the "Virchow-Hirsch Jahresbericht." In America, Prof. Da Costa is especially to be mentioned. In Germany I do not find these practical questions discussed in the text-books with the precision and exhaustiveness which appear desirable. Among the writers of smaller articles are mentioned G. Mayer, "Ueber heilbare Formen chronischer Herzleiden einschliesslich der Syphilis des Herzens." Aix, 1881. Also Dr. Levinsky who read in this society a paper "Ueber die Prognose der Herzklappenfehler, namentlich die Heilbarkeit der Aorten-Insufficienz." I also mention a discussion between Prof. Riegel and Von Dusch, which touched upon several points in the prognosis of diseases of the heart.

The literature is, therefore, not very rich in this respect, and I hope that perhaps by articles from our society this hiatus in German literature may be filled in a measure.

Until not very long ago, the prognosis of diseases of the heart was regarded as very grave. Every such patient was considered incurable, a candidate for death, who could suddenly fall dead at any moment; *haeret lateri letalis arundo*.

This sentence was placed by Corvisart at the head of his celebrated work on diseases of the heart, and this pessimistic opinion for a long time weighed heavily upon these patients. They were regarded as condemned to death, as a *noli me tangere*. No one dared to touch the fatal arrow. It was taken for granted that we must wait passively until death released the patient. It was only by degrees, and especially in very recent times, that this doleful view gave way to a more hopeful and cheerful one. We have not attempted to cure the valvular disease, but rather to secure for the patient a life free from suffering, or at least endurable, and to prolong existence to a considerable extent. By degrees we have become convinced that many patients with disease of the heart do not experience so much suffering, that they may lead a life full of activity and enjoyment, and that they may enjoy this for many years. Indeed, I find that the laity by no means have such a pessimistic opinion of diseases of the heart as physicians themselves. I have often convinced myself, when I delayed in telling a patient that he suffered from heart disease, that he was not so much terrified as I had apprehended. An important reason which appeared to justify the pessimistic prognosis of cardiac disease lies in the experience that such patients who are still in a tolerable condition not infrequently die suddenly. It has therefore been inferred that they are not secure of life for a single moment, but a more careful examination, such as has been made particularly by English physicians, has shown that in the majority of chronic diseases of the heart sudden death is a rare event. There are only two forms of these diseases in which sudden death occurs more frequently, namely, insufficiency of the aortic valves ("Aortic Regurgitation" as the English prefer to term it; also "Aortic Reflux") and true angina pectoris (Heberdenii). For both diseases we must formulate the prognostic dictum that such patients are not sure of life for a single day, but that life may be preserved for years without any definite limits. With regard to both, I myself have made numerous observations with regard to sudden death, and particularly in the case of aortic insufficiency my experience both in hospital and private practice is unfortunately very large. I have seen the sudden death occur very often in patients who felt quite well, especially those who had passed through a period of severe disturbances

of compensation, and appeared to pass gradually into a promising convalescence. I may add, however, that so far as my memory serves, these cases were always attended with severe sequelæ, especially with pronounced dilatation of the left ventricle, yet the fatal termination occurred unexpectedly in a majority of these cases. In the remaining forms of valvular affections sudden death occurs with comparative infrequency, in mitral lesions in only about two per cent of the cases; that is, so rarely that the physician may neglect this unfortunate termination in the prognosis. We are not able to guarantee life even to perfectly healthy people. Unexpected accidents and sudden deaths occur in health and other cases of disease, and not much more frequently in the majority of cases of heart disease. It would be wrong to call the attention of the patient to this remote possibility, since we cannot prevent it. We should permit the patient the greatest amount of freedom from care and not hang over him the sword of Damocles, which stamps him as a condemned individual deprived of every enjoyment in life.

I may also mention another series of pathological conditions of the heart which sometimes give rise to sudden death. For example, anæmic (degenerative) fatty heart. Also the later stages and beginning of convalescence of acute diseases; sudden death may also be produced by strain or great emotional excitement, but these accidents can be hardly called such as affect especially patients suffering from heart disease. They are rather general conditions, temporary in their nature, which have led to weakness of the heart. Moreover, even these accidents are so rare that they cannot be regarded in the prognosis. In general, it is very probable that heart death is the most frequent cause of sudden death (I do not refer to sudden death in diseases of the heart). It would be very interesting here to obtain from judicial autopsies statistics of sudden deaths. With the exception of certain definite forms, therefore, sudden death is not a frequent occurrence in diseases of the heart. The majority of these patients live for a number of years, and in no small number the duration of life is not shortened in a material manner.

I will now arrange the further remarks on the prognosis of diseases of the heart according to three standpoints: 1st, with regard to the general disposition and conditions of life;

2d, with regard to the special groups of diseases of the heart;
3d, with regard to individual physical or physiologico-pathological symptoms.

I. Under the first head I first mention the age of the patient. Apart from the definite form of the heart disease this has a prognostic significance, in so far as young children tolerate heart diseases very poorly, and succumb to them very readily. In later childhood, youth, and early manhood, on the other hand, the prognosis of heart disease is in general most favorable. This is owing chiefly to the fact that at an early age those forms of heart disease which furnish a relatively favorable prognosis predominate. At an advanced age, on the other hand, those forms are most frequent which entail a grave prognosis. The most frequent causes of heart disease of advanced age is arterio-sclerosis, which bears within it the decided tendency to a more or less progressive course. This progressive course may be very slow. Indeed, it may come to a standstill for a long time, but the fear of its rapid spread is present at all times. The arterio-sclerosis occasionally develops very early in the heart and large vessels, even in the thirties—cases which for this very reason are explained with difficulty. On the other hand, I desire to emphasize the fact that the compensation of valvular lesions occurs as readily at an advanced age as in youth. With advancing age the heart increases in size and functioning power. In fact, the heart is the only organ whose relative mass increases with age. In young people, the organ is perhaps more easily exhausted than in older individuals. The sudden death in insufficiency of the aortic valves occurs at least as frequently in young people as it does in the old.

The second general etiological factor to which I desire to call your attention is sex, which must be considered with regard to the prognosis of heart disease, in so far as the female sex in general admits of a decidedly better prognosis than the male. I find this relation so sharply defined both in hospital and in private practice, that I desire to express this statement with decision. In hospital practice, it is true, the difference in sex does not appear so sharply, because women in the lower classes live in almost the same manner as the men, and are subjected to the same hard labor, emotional excitement, and in part, excesses. The reason for this difference in the prog-

nosis between male and female patients with diseases of the heart resides in the fact that the female sex is less exposed to the causes which produce severe cardiac affections. Among these, I include first, arterio-sclerosis, which in the female sex, even in the working classes, is much rarer than in males, and in families in which it is hereditary, attacks the female members to a slighter extent. According to my experience also, true angina pectoris permits in general a much better prognosis in the female than in the male. Furthermore, hard work, excessive bodily strain, and alcoholic excesses are much less frequent in females. Moreover the feminine character is more suited to bear the discomforts of diseases of the heart and thus to ameliorate its course. Finally, experience teaches that women are more attacked by those lesions of the heart which permit a more favorable prognosis. Mitral lesions occur mainly in females; aortic insufficiency in males.

The third point in the general etiological conditions refers to the mode and conditions of life. As a general thing, patients of the wealthier classes tolerate heart disease better than those of the working classes, because the most dangerous foe of existing lesions of the heart is bodily work and strain. It leads to heart failure and disturbances of compensation. Very much depends, therefore, upon the condition and occupation. Existing heart disease is often aggravated by emotional excitement. The patient requires an existence which is free from care, good nourishment, and general care of the body. The character must also be considered, inasmuch as violent passions, excesses, and carelessness often injure the patient, and a careful, quiet, and temperate individual will tolerate such a disease much more easily and will succumb at a much later period.

Finally, the prognosis is also influenced by the manner in which patients react to drugs. Our remedies, even the principal one, digitalis, do not always possess a certain and constant effect. Their action is easily exhausted, and they finally fail to act. A patient in whom these remedies act promptly is undoubtedly in better case, particularly if the effect obtained lasts for a longer time. The more rapidly the action of digitalis diminishes and disappears, and the more often we are forced to resort to this remedy, the more the fear increases that its activity will diminish and cease. It is therefore one

of the most important and difficult tasks to administer digitalis economically, and it is in this very regard that the physician who is experienced in diseases of the heart will appear at his best. If at all possible, we should not give too large doses of the drug, and should not allow them to be continued too long (at most three bottles of 1.00); then the remedy should be discontinued from two to three weeks. In this way we will preserve most easily the efficiency of the digitalis and thus have at hand a remedy which will restore the disturbed compensation. If the digitalis fails to act, we are not entirely powerless, but the prognosis becomes so much more unfavorable, because the effect of the other analogous drugs and of the other methods is much more uncertain.

Before I proceed in my remarks I desire to demonstrate a heart. The case is apropos of my lecture in so far as we have to deal with a sudden death from insufficiency of the aortic valves. The patient was a coachman, æt. thirty-five years, admitted to hospital March 11th, 1889, and died suddenly on April 13th. He came to the First Medical Clinic in a miserable condition, with very notable disturbances on the part of the heart, severe dyspnœa, great weakness, restless nights, œdema of the lower limbs. Physical examination showed the signs of insufficiency of the aortic valves. With regard to the previous history, it was found that the patient had never suffered from articular rheumatism. As he belonged to the working classes I inquired with regard to overwork. The patient stated that he was not concerned directly with especially hard work, but that as a furniture-truck driver he was compelled repeatedly to help in carrying furniture. He himself did not attribute his disease to overwork, but said that it began with cough in January; a few days later he suffered from dyspnœal attacks which developed into signs of a severe lesion of the heart. It may be assumed that the patient, who evidently did not observe himself very closely, was not kept in bed by a simple cough, but that the cough was the expression of a cardiac lesion, and that the dyspnœal symptoms developed more strongly in the course of a few days. The patient does not mention any distinct cause, but it is noticeable that he dates his disease from a certain day. As this occurred after Christmas and New Year, it is, at least, not to be excluded, although not demonstrated with certainty, that

he experienced a sudden excessive strain, and the specimen rouses the suspicion that we have to deal with a rupture of the aortic valves as the result of strain. The patient entered with very severe symptoms. The condition was gradually improved. The pulse became more vigorous, the nights were quiet, and the patient began to recover. He asked to get up, but this was not permitted. He appeared to be doing well. He had been up five or six days, but had not yet left the room, when, one day after he had been out of bed for a few hours, he suddenly felt ill. He was rapidly put into bed, but falls forward, and is dead. Here, therefore, we have sudden death in insufficiency of the aortic valves, as I have unfortunately observed in many cases. I emphasize the fact that we have to deal here with a severe case. The specimen is interesting, from the fact that the aortic valves exhibit openings. In one place a paper roll as thick as a lead pencil has been carried through the base of the valve and this opening has not been enlarged post mortem to any noticeable extent. The heart has been kept in alcohol and therefore would be more apt to have shrunk. The third valve is also torn and covered with vegetations, which do not contain micrococci but are formed of deposited fibrin from the blood.

II. In continuing my review, I proceed to the second part of my prognostic considerations, and will discuss the heart diseases according to their diagnostic form. In this respect, I distinguish three groups: 1, the non-organic heart lesions or heart diseases; 2, the diseases of the heart muscles; and, 3, the valvular lesions.

1. When we examine a patient who complains of heart symptoms, or states that he has disease of the heart, it is our first duty to decide whether we have to deal with an organic affection or not. I use the term "organic" in the sense that a true anatomical lesion is present, while often valvular lesions alone are understood under this term. In my sense, however, the distinction is evidently more precise. We are to determine whether we have to deal with anatomical, that is, organic lesions of the heart, or with non-organic diseases, that is, with heart symptoms without true anatomical lesions. These non-organic diseases are also called nervous or neurasthenic or functional affections of the heart. Their separation from the organic is not entirely distinct and cannot be determined

definitely in every case, but in principle the differentiation is extremely important. Its significance resides in the fact that we can at once give a much better prognosis in a non-organic disease of the heart, while organic affections entail a serious, if not grave prognosis. This distinction is so much more important because the nervous affections of the heart occasionally appear with very violent and threatening symptoms which terrify the inexperienced, but we can at once give a good prognosis as soon as we are certain of the diagnosis of a nervous disease. I must mention, however, that this rule has a few rare exceptions, that nervous affections of the heart, for example, from fright or grief, especially in older people, may be attended with serious sequelæ, and also that sudden deaths have been observed occasionally as the result of fear and terror. The certain diagnostic differentiation between an organic and a non-organic affection of the heart is by no means always easy. As a rule, we assume a non-organic disease when the most careful physical examination reveals no abnormality either on percussion or auscultation. This diagnosis is confirmed when we have to deal with young neurasthenic and especially female individuals. But even this conclusion, which is generally justified, must be restricted in two directions: in the first place, murmurs (anæmic, accidental) may occur in non-organic affections of the heart. They are almost always systolic and loudest at the apex. Even dilatation of the heart may occur, as is shown in the most striking way by Basedow's disease. On the other hand, profound organic diseases of the heart, particularly of the heart muscle, may exist, although no abnormality is demonstrable by physical examination. The diagnostic and prognostic judgment in this respect may be very difficult. It was formerly believed that a heart in which a murmur was heard is diseased, that one in which no abnormal physical signs are present, is healthy, but the continued investigation of the facts has shown that neither one nor the other conclusion holds in all cases. Angina pectoris is very important in this regard. I distinguish three principal forms: true angina pectoris (*Heberdenii*) which depends upon disease of the coronary arteries; next symptomatic angina pectoris, which appears occasionally in almost all forms of heart disease; and nervous or neurasthenic angina pectoris. The symptoms of the first and third forms may be

very similar. In both physical examination affords no positive findings, but their prognostic significance is extremely different. In such cases the chief factor in differentiation lies in the consideration of the general conditions. When elderly people, especially men, are attacked by angina pectoris, we have to deal probably with the organic form. In young, anæmic female individuals we assume, other things being equal, the nervous form. The diagnosis may be very difficult when, as I have seen on several occasions, nervous angina pectoris develops in old men, and it can then be obtained only after an accurate knowledge of the individual and of the course of the disease. I must also mention Basedow's disease, which illustrates the fact that nervous affections may also be attended with dilatation of the heart. In proportion to the violent symptoms this disease furnishes a relatively favorable prognosis, inasmuch as it may be not alone easily borne, but may also retrogress, and it is only in the highest grades in older people and in other complications, that life is directly threatened. Brief mention may be made of the nervous affections of the heart in diseases of the spinal cord, concerning which we have as yet but slight experience. I have described one form of angina pectoris in tabes dorsalis, which was attended with very severe symptoms; in one case it appeared to be connected with the fatal termination. Conditions of heart weakness and paralysis with a fatal termination have also been observed in progressive muscular atrophy and bulbar paralysis.

2. The second group are the diseases of the heart muscle. These form an extremely important part of the general diseases of the heart. Indeed, if we include conditions of the heart muscle with the valvular affections, we have now to discuss perhaps the most important part in the general doctrine of cardiac affections. As a matter of course, diseases of the heart muscle are diagnosed with much more difficulty because they are accessible only in small part to physical diagnosis. For a long time they were very much neglected or included in the general notion of myocarditis. At the present time, we know at least that very different affections are presented. A general prognosis of diseases of the heart muscle can therefore be made with extreme difficulty. The forms which can be diagnosed physically may be classified in three groups: 1st,

hypertrophy; 2d, dilatation, and, 3d, heart failure or insufficiency of the heart. These three forms are distinguished quite sharply physically, but they may be associated and pass into one another. I make the distinction only to add some prognostic remarks, first, in the direction of the danger which these changes in the heart muscle bring, and, secondly, in how far they are capable of improvement or recovery, especially when we take into consideration our new therapeutic methods. From this standpoint it may be said at the start that hypertrophy is no disease *per se*, and therefore cannot be the subject of treatment. The English writers, particularly Corrigan, have justly emphasized the fact that hypertrophy is not a disease, but on the contrary, the compensation of a disease; that it is not to be combated but to be assisted. But hypertrophy is the expression of severe disease which is situated outside of the heart, whether in the arterial system or in the kidneys. The more marked the hypertrophy the more marked is the causal affection, and the prognosis of hypertrophy of the heart will depend upon the degree and the importance of the disease which we presuppose as its cause. On the other hand, despite the existence of hypertrophy, a condition of exhaustion, heart weakness, or paralysis may set in attended with evident and rapid danger to life.

Dilatation of the heart is the most important with regard to prognosis. That it is to be distinguished from hypertrophy I may assume to be sufficiently well grounded, although the combination of hypertrophy and dilatation is a very usual one, and I do not wish to maintain that the distinction between the two is always easy. Yet this question is not very important diagnostically, because in that form of dilatation which is independent of hypertrophy, as a rule, severe heart symptoms, such as dyspnoeal conditions or even circulatory disturbances, are present. In general, dilatation undoubtedly furnishes a more unfavorable prognosis than hypertrophy, because it is the expression of a condition of distention of the heart muscle, and such conditions result in weakness of the organ, which always entails danger.

The question now arises concerning prognosis: 1, whether every dilatation is co-ordinate with regard to prognosis, or whether differences exist; and, 2, whether we possess means, either with the aid of nature, or by our methods of treatment,

which will improve or cure the dilatation. The first question is to be answered by the statement that the causes and significance of dilatation of the heart present manifold differences. We must especially distinguish those dilatations which result from valvular lesions, from those which apparently appear independently. As is known to you, our esteemed Chairman, Dr. O. Fraentzel, has called the latter idiopathic dilatations, and has made them the subject of special study. Without doubt, these excellent investigations which have recently been presented to the medical public in a special article are sufficiently well known to you.

As regards the prognosis of dilatation of the heart in general, it must first be remarked that dilatation of the right half of the heart is of much less significance than that of the left ventricle. Dilatations of the heart which are manifested by enlargement of the area of cardiac dulness upon the sternum, and beyond it toward the right, and which are often associated with enlargement, distention, and dilatation of the cervical veins, may develop rapidly and may disappear with equal rapidity. They are apt to develop in all stases in the lesser circulation, in pneumonia, emphysema, pleural effusions, etc. In valvular lesions, especially mitral disease during an exacerbation, we also find them increase notably, and then retrogress. The right heart, especially the auricle, is as easily distended as a venous vessel and readily accommodates itself to a greater or less stasis of blood in the lungs. Without doubt, such a dilatation may disappear quickly, and is not very important in the prognosis of the cardiac affection. I will not fail to mention, however, that hypertrophy of the right ventricle, after it has lasted for some time, is not so apt to retrogress. This is manifested, not so much by increased dulness on the right side, as by the intensified apex beat (at the left border of the sternum).

In the left ventricle matters are entirely different. Its dilatations are of the greatest importance as regards the function of the heart. They threaten heart failure, and if they continue, endanger life. Nevertheless, it is undeniable that these dilatations do not always furnish a grave prognosis and that some cases may undergo retrogression and complete cure.

In my opinion this is true undoubtedly of the rapidly developing dilatations, especially after acute diseases. Traube

observed dilatation of the heart without endocarditis in the course of acute articular rheumatism, and I have repeated this observation several times. Analogous dilatations also occur after other infectious diseases, typhoid fever, measles, scarlatina, erysipelas, diphtheria. The mildest forms of this variety are recognized only by the audible galop-rhythm. Other cases reveal distinctly a displacement of the apex-beat to the left. These dilatations are capable of complete recovery even when they are attended with grave symptoms of heart weakness and tachycardia. I do not mean to imply that all such cases are curable, or free from danger. On the contrary, it is well known that, for example, the heart affection after diphtheria endangers life in the highest degree, and also the dilatation after scarlet fever, when it is the result of an intense nephritis.

In like manner the dilatations of the left ventricle which result from strain—with or without coincident valvular lesion—may also undergo retrogression. I have been able to convince myself repeatedly of this when patients with fresh strain of the heart were brought to the clinic. The apex-beat, which was pushed beyond the left mammary line, returned to the normal position as soon as the patient was improved by rest and suitable treatment; the difference occasionally amounted to 1 to 2 cm. I observed this affection particularly in two cases of heart strain which returned in the course of their disease (of several years' standing) repeatedly to the clinic with exacerbations of the disease. The first examination then showed displacement of the apex beat to the left beyond the formerly observed limits, and after a few days a return to its normal position.

Finally, the dilatation of Basedow's disease may also disappear.

The matter is somewhat more difficult in dilatations which have developed slowly and continued for a longer time, whether in the dilatation called idiopathic by Fraentzel, or in the dilatation of aortic insufficiency or chronic nephritis. In all these cases the prognosis is serious and depends in the individual case upon the degree of dilatation, the process which had led to the dilatation, and the intensity or stage of the sequelæ, which are very similar to the disturbances of compensation in valvular lesions. The most unfavorable cases are those in

which the dilatation depends upon a progressive process such as arterio-sclerosis. The chronic forms of myocarditis furnish very slight hope of successful treatment. But even when retrogression of the dilatation can no longer be effected we may hope to improve the function of the heart muscle and restore compensation. In the majority of cases of considerable dilatation, however, even this succeeds only temporarily. In the future we may hope to attain better results. I regard the treatment of dilatation of the left ventricle as a problem of our modern therapeutics. We succeed occasionally in producing temporary diminution in size by digitalis. The new methods of cardiac therapeutics, the dietetic, mechanical plan of Oertel, the gymnastic of Zander, and the treatment with baths, have opened the prospect of securing the cure of dilatation of the heart and converting it into a desired hypertrophy, even in those cases which cannot be cured permanently by our previous methods. But it is desirable to obtain unanswerable proofs for this assertion, and at the same time, to remember the possible sources of error which may occur in the examination and comparison of the size of the heart.

The third form, weak heart, insufficiency of the heart, may also depend upon very different causes. Its symptoms are so evident and easily recognized that the diagnosis, as a rule, is patent. The weakness of the heart's action is shown by the smallness of the pulse, which is sometimes very frequent, sometimes slow, and easily compressed; by general weakness, striking pallor and coldness, syncope, dizziness, and oppression and feelings of anxiety. It is evident that a condition in which the heart muscle threatens to be paralyzed is very distressing and dangerous. The question whether, and under what circumstances this heart weakness can be overcome is a very pressing one. In the first place comes the diagnostic question, whether the heart is organically diseased or not. This distinction is very important in prognosis, although even the weakness of a non-organically diseased heart may become very dangerous at any moment. In general, however, this functional weakness is of slighter significance. In young, neurasthenic, especially hysterical individuals, the prognosis is always more favorable, especially if we know that the patient has suffered from similar attacks before. Youthful age, female sex, offer a more favorable prognosis of heart weak-

ness, although the symptoms are almost always threatening and disquieting.

The most dangerous is the acute (suddenly occurring) heart weakness in febrile diseases, both at the height of the fever, and particularly at the fall of temperature and beginning of convalescence. The justly dreaded collapse of febrile diseases and the sudden cases of death at the beginning of convalescence depend essentially upon rapidly growing heart failure. The rapid heart failure of angina pectoris and anæmic fatty heart is almost equally dangerous, although these conditions may be recovered from. At all events, these accidents are so important that the physician must be able to recognize the first signs in order to prevent the catastrophe.

The chronic cases of heart weakness (called weakened heart by Stokes) occur in all chronic affections of the heart with or without valvular lesion.

They develop when the heart muscle becomes too weak to fulfil the work required. This results in those conditions of stases, insufficiency of the heart, which correspond to disturbances of compensation in valvular lesions, and are best known as such. The work of the heart is either increased abnormally, as in valvular lesions, arterio-sclerosis, cerebral diseases, or if normal, the vigor of the heart is diminished by diseases of the myocardium (myocarditis) or nutritive disturbances (anæmia) or poisoning (alcohol, etc.) or dilatation (idiopathic dilatation).

The prognosis of this chronic insufficiency of the heart will depend upon its degree, but chiefly upon its cause. Progressive diseases, such as arterio-sclerosis, and cerebral affections, which have led to diseases of the heart, offer but slight prospects of complete restoration, while conditions of poisoning or imperfect nutrition, or strain are capable of restitution. The conditions here are very analogous to the disturbances of compensation in valvular lesions and the prognosis depends in great part upon the condition of the heart muscle and the intensity of the sequelæ. Further on we will return to these conditions. Here we will merely remark that in addition to the medicinal treatment the new methods of cardiac therapeutics, especially the mechanical treatment, promise much better results than those hitherto obtained. They are said to be able not alone to overcome the weakness of the heart but

even to include a definite increase in the heart muscle. The indisputable proof for this assertion is not offered easily, and I believe we must await further tested observations before a final conclusion is possible. But it appears to me to be of less importance to decide whether the favorable effect is attributable directly to the cardiac gymnastics or rather to the general improvement in nutrition and function of the entire organism, in which the heart takes part in an eminent degree. A stimulating and tonic action upon the heart muscle is also claimed from the use of warm baths, and this is even compared with the action of digitalis.

We will also devote a few lines to fatty heart, which deserves special mention among diseases of the heart muscle. As I have formerly pointed out, we must distinguish two forms of fatty heart: *a*. The heart in obese individuals; *b*, fatty degeneration of the heart muscle.

The heart in obesity presents various forms and degrees of change which must be judged in different ways. So long as there is merely an accumulation of fat upon the heart, while the heart muscle itself is healthy, so long the prognosis is relatively favorable. Even when dropsical symptoms are already present the prognosis is not bad, and we not infrequently see such cases cured even in the hospitals. Suitable dietetic treatment, accompanied by methodical, muscular action, practised according to the principles of the Oertel method, produce recovery in such cases. But if further changes of the heart are present, especially dilatation of the left ventricle, with pronounced weakness of the heart, the prognosis becomes very doubtful and may become very dangerous at any moment. This is still more true when in elderly obese individuals arterio-sclerosis is added to simple fatty heart, progresses slowly and produces incurable conditions. The dangerous dilatation of fatty heart occurs chiefly in the left ventricle. Enlargement of the heart to the right, beyond the sternum, has no material prognostic importance, especially as this dulness is frequent in obese people and depends upon the abundant development of fat on the pericardium.

The second form, which is also often called fatty heart, is fatty degeneration of the heart muscle. Years ago, I showed that this latter form, as such, is hardly capable of anatomical diagnosis, that it can only be inferred with probability from

the symptom of distinct heart weakness in poorly nourished and anæmic individuals. If we have to deal with simple anæmia or weakness, the prognosis is not unfavorable, but in all severe anæmia and cachexia the accompanying heart affections also furnish an unfavorable prognosis, and in general these forms depend in great part upon the significance of the general condition. We now come to

3. The discussion of the prognosis of valvular lesions. 7
Here the important question first arises whether valvular lesions can ever be completely cured. This question has been discussed a number of times in German literature. One of the earliest and most important articles was furnished by Jaksch, Sr. (Prague, 1860), who first showed with certainty that valvular lesions may recover completely. In his text-book on Auscultation and Percussion, Gerhardt (1868) reports several cured cases (two mitral lesions, one aortic lesion). Then Benecke ("Zur Therapie des acuten Gelenkrheumatismus und der mit ihm verbundenen Herz-Krankheiten"), in calling attention to the curative power of the Nauheim thermal waters, reports fifty-five cases of valvular lesion which were improved or cured by the use of these baths. G. Mayer, in Aix, in his article "Ueber heilbare Formen chronischer Herzleiden" (1881), mentions several cases of cured valvular lesions in his own practice (two mitral insufficiencies). Finally, in our own society, Levinsky held an interesting address on April 17th, 1882, on the prognosis of valvular lesions, which was followed by a vigorous discussion. Levinsky showed that the majority of the known cases of cured valvular lesions were mitral insufficiencies, but that aortic insufficiencies may also heal. He reported one case in which the diagnosis of aortic insufficiency had been made by Traube himself and in which Levinsky noted the recovery. During the discussion, Dr. Badt reported a case of cure of aortic insufficiency. Fraenzel reported two cases of mitral insufficiencies, one of stenosis; and I reported two cases of cure of aortic insufficiency. It is hardly necessary to add anything further to this exhaustive review of the general literature. In the discussion which followed Dr. Broadbent's lecture, Dr. Campbell Black mentions the following: In a youth of fifteen to sixteen years two aortic murmurs were discovered accidentally, although the patient suffered from no symptoms. At the end of five years he married against the advice of the

physicians, had children, etc. Five years later, another examination of the heart showed that the murmurs had disappeared entirely. The patient appears and remains healthy.

From all these observations it is undoubted that valvular lesions may recover, but that the large majority of the recoveries occur in mitral insufficiency. It is indeed proven that aortic insufficiency may also recover, but with comparative rarity. By recovery we mean, as a matter of course, not alone the disappearance of the murmur, but also the permanent disappearance of all heart symptoms. But the cardinal point lies in the permanent disappearance of the murmur. This proof must arouse some suspicion with regard to aortic insufficiency, because it has been demonstrated that the diastolic regurgitant murmur at the aortic valves may disappear, although the insufficiency and its mechanical results have not been compensated. In the experimental examinations on artificial valvular lesions made by E. Klebs, O. Rosenbach, Jäger, François Frank, it was found that in rabbits a diastolic murmur was rarely heard, despite the destruction of the aortic valves. Furthermore, it has been observed by myself and others, that in cases in which the aortic insufficiency was combined with aortic stenosis, the diastolic murmur disappears as soon as the stenosis has reached a high grade. Finally, Staff Surgeon Renvers, in an article entitled: "*Casuistische Beiträge zur Lehre von der relativen Insufficienz der Aortenklappen*," "*Charité-Annalen*," 1888, p. 223, has shown that in aortic insufficiency resulting from arterio-sclerotic dilatation of the ascending aorta, the murmur increases as soon as distention of the aortic ring is produced by the increased blood pressure, but that this murmur disappears in rest when the aortic pressure is lessened. To this must be attributed a portion of the cases of aortic insufficiency reported as cured.

Hence it follows that valvular lesions which have undoubtedly been observed may be cured in the course of time, and this is true not only of mitral lesions but also of aortic lesions. In the latter, however, such a real and permanent cure is so rare that the physician can hardly take it into consideration with regard to prognosis. Mitral insufficiency, on the other hand, warrants a certain hope of recovery, especially in those cases in which it is recent and has developed from an acute disease. Complete recovery can be expected so much the

more if no sequelæ dependent upon the valvular insufficiency have yet developed. But while the recovery of a valvular lesion must be regarded as exceptional, the second question arises, what is the prognosis of a valvular lesion which does not recover? Experience has taught unquestionably that valvular lesions, recognized by undoubted physical signs, may exist, although the patient experiences no discomfort whatever. The patient is often examined for some other reason, and the valvular lesion is then discovered accidentally. This fact, that valvular lesions are discovered accidentally, and that the patient feels perfectly well, has been known for a long time. We describe this condition as the stage of perfect compensation. The disturbances which might arise in the mechanism of the circulation, as the result of valvular disease, have been prevented by the increased action of that part of the heart situated behind the mechanical disturbances. In practice, as a matter of course, the prognosis which is to be given in those cases in which the patients feel perfectly well is a very important matter. Until recent times such a patient, although he felt perfectly well, was nevertheless regarded as a candidate for death who might die at any moment. "*Hæret lateri letalis arundo.*" The patient himself considered himself as lost; the parents of the unwitting child looked with deep sorrow upon their condemned darling. Compared with these gloomy, pessimistic views, it is to be regarded as an advance whose importance cannot be underestimated, that we have learned more and more from medical experience that such complete compensation may last for many years and that the patient during this time may enjoy life undisturbedly. At the present time, such experiences are no longer rare, and every experienced physician will remember one or more illustrations of this kind in his practice. It was, therefore, a meritorious service, when Sir Andrew Clark, of London, in his lecture to which I have already called attention, made mention of 684 cases in his own experience in which a chronic valvular lesion of the heart had lasted at least five years, although its presence was not indicated by symptoms which had materially disturbed health. The patient consulted the physician for other symptoms (dyspepsia) and the heart lesion was discovered accidentally. In many cases the stage of undisturbed compensation lasts much longer and much more than five

years, even twenty years. It is undoubtedly worthy of note that the absence of heart symptoms for years was determined in such a considerable number of cases. This fact is of the greatest practical importance. It follows, in the first place, that we may not regard every case of heart disease as a candidate for death, and may not treat him in a corresponding manner, but that we must permit him to retain his unconstraint as much as possible. A. Clark mentions cases in which the patient, treated, since the diagnosis of valvular lesion, like one grievously sick, maintained a gloomy existence, secluded from the world; but from the fact that he was permitted to resume his occupation and enjoy life, he was so encouraged and stimulated as to consider himself almost cured. Correct as this medical treatment is, it seems to me to be going too far when Bristowe says: "So long as any one suffering with an affection of the heart suffers no symptoms, he should not be informed concerning it, and should continue in his customary mode of life." I am surely not one of those who regard it as the duty of the physician always to communicate to the patient or his relatives the whole truth concerning his condition. On the contrary, the fortunate unconstraint of the patient would often be lost as soon as he obtained knowledge of his incurable disease. This knowledge is often much more serious than the disease itself. But a patient with a valvular lesion may not live as freely as a healthy individual, and must know sufficient concerning his disease so that he will not expose himself to influences which may aggravate his condition. Oertel says with justice: "It is a dangerous mistake that patients with well compensated valvular lesion require no special advice." On the contrary, he can retain permanently his relative condition of health only by avoiding certain noxious influences, among which we may mention particularly bodily strain, while other influences, such as cold, alcoholic drinks, tobacco, coffee, etc., are also important.

Another practical question is, What occupation in life shall a child suffering from valvular lesion select at a later period, especially, whether military service, for example, is possible? The latter question is to be answered in the negative almost in every case, but it does not appear to me to be absolutely imperative to advise a patient who acquires a valvular lesion while in the service to abandon his calling at once. At all

events, mitral insufficiency does not require this decision in every case. Life insurance must also be considered. In England, it appears that a well-compensated valvular lesion does not prevent acceptance in life insurance. In our country such patients may not be accepted. Finally comes the question of marriage. Marriage is not entirely devoid of danger in patients suffering from heart disease. Males may suffer injury from sexual excess. In women pregnancy produces material disturbances. Women suffering from heart disease are very apt to experience disturbances of compensation with dropsy during pregnancy, although this is by no means always the case. I have seen a number in my clinic; the majority recovered after a confinement. The delivery itself passed off well, compensation was restored, but some suffered irretrievable disturbances and did not recover.

Since experience teaches that valvular lesions in many cases may remain for a long time in a state of complete compensation, without notable impairment of health, but that, on the other hand, very many lesions are rapidly aggravated and lead to death, we must attempt in the individual case to make the prognosis more precise, that is, to say whether the case in question is one which permits us to hope for a long stage of compensation, or one which will probably take an unfavorable course. The following data may be considered in determining this part of the prognosis:

a. The first point is, what valve is diseased, and in what manner (whether insufficiency or stenosis). Among all valvular lesions, mitral insufficiency furnishes the best prognosis, that is, it gives the best guarantee both for recovery and for the prolonged maintenance of compensation. The worst prognosis is furnished on the average by insufficiency of the aortic valves, in which the chance of sudden death must also be taken into consideration. Next to this we may mention mitral stenosis. In order, however, to avoid misunderstanding of my statements I will expressly mention that mitral insufficiency and aortic stenosis also occasionally run a very unfavorable course, and that cases of aortic insufficiency are known in which this lesion has lasted for ten, fifteen, or twenty years without noticeable symptoms. I myself have known for fifteen years of a gentleman suffering with this valvular

lesion which, being completely compensated, has produced no symptoms up to the present time.

The prognosis of aortic insufficiency exhibits great differences. As is well known it occurs in two forms: the endocarditic form, other things being equal, gives a better prognosis than the second, the arterio-sclerotic form, which appears at an advanced age (occasionally at an unusually early period), and is thus due to a progressive process. It is also to be noted that the presence of the diastolic sound in the aorta (in addition to the diastolic murmur) improves the prognosis, inasmuch as it allows us to infer a relatively slight insufficiency.

b. The sequelæ in the heart must also be taken into consideration. The less marked the hypertrophy (dilatation) of that part of the heart situated behind the lesion, the more favorable is the prognosis. Considerable dilatations are more unfavorable. The least favorable is marked dilatation of the left ventricle, with insufficiency of the aortic valves.

c. The intensity of the murmurs.

It might be supposed that the valvular lesion is so much more severe the louder the murmur dependent upon it. But this is not true, as has already been stated, particularly by the English writers. On the contrary, loud, distinct murmurs are more favorable than very feeble ones. It is well known that in mitral stenoses when they become very intense the pre-systolic murmur disappears more or less completely and an analogous condition holds good in aortic lesions. I can confirm this experience entirely from my own observation. Broadbent says: "Physical signs are often deceptive. There is no greater mistake than to measure the danger of a valvular lesion by the intensity of the murmur," and in another place: "As a rule, a loud murmur is less serious than a feeble gentle one. The latter indicates weakness of the heart, which entails the greatest of all dangers. Gairdner also says: "Inexpert observers tend to overestimate the significance of murmurs and to pay too much attention to the mere character of the sounds, while underestimating the other conditions under which the murmur develops.

d. The nature of the endocarditic process, especially with regard to the question whether it is a stationary or a progressive one. The importance of this question is evident. There are a number of valvular diseases which may be called sta-

tionary. In another series of cases the process has a decided tendency to progressive advance. As a rule, congenital heart lesions are entirely stationary. The process has run its course, does not relapse, and the well-established compensation is not disturbed apart from special accidents. I know a young lady who has been a patient of mine for twelve years and who then consulted me concerning a heart lesion which was regarded by some physician as an aneurism. I made the diagnosis of congenital insufficiency of the pulmonary valve. The patient had no further disturbances, except that she occasionally felt the murmur and occasionally only thought that she felt them.

But up to the present time, the condition has remained the same. The patient has become accustomed to her heart trouble and has learned not to notice it further. Moreover, this patient is a twin and has developed as rapidly and vigorously as her sister, who does not suffer from congenital heart lesion. Almost equally favorable are the conditions in valvular lesions after acute diseases, especially in the mitral insufficiencies after chorea. It is known that valvular lesions develop not infrequently in chorea; most frequently, mitral insufficiency, rarely aortic lesions. The former are not alone stationary, but recover quite frequently, while aortic lesions remain stationary.

(A. Clark makes the following statement: "The murmurs of mitral insufficiency after chorea disappear usually in eight to nine days after the attack.")

Among febrile acute diseases, articular rheumatism, as is well known, leads not infrequently to endocarditis and valvular lesions. More rarely, but also undoubtedly, it appears after measles, scarlatina, diphtheria, and typhoid fever. The endocarditic process in these cases is benign and has no tendency to progressive advance. The articular rheumatism presents the danger of a relapse of this disease with which an exacerbation of endocarditis is often associated. On the other hand, the heart lesions after measles and scarlatina, which almost without exception attack the patient only once, remain stationary and furnish a relatively favorable prognosis. It goes without saying that here, other things being equal, mitral insufficiency is also the most favorable, aortic insufficiency the most unfavorable, valvular lesion.

To the progressive, and therefore, unfavorable forms of

valvular lesion belong all those which result from arterio-sclerosis: those arising from strain are also often progressive. Nevertheless, it must also be remarked that many cases of aortic lesions in older people which undoubtedly are due to arterio-sclerosis, may remain stationary for years.

Finally, mention is to be made of febrile or septic endocarditis. That this form is comparatively malignant is evident. It is often, though not always, connected with pronounced valvular disease, especially of the aortic valves, and develops without existing or pre-existing articular rheumatism. The fever is continued, remittent or intermittent, and characterized by its long duration, despite all the measures employed. The consumption arising from the persistent fever entails an unfavorable prognosis. Occasionally embolism of the brain, limbs, etc., is also superadded. Unfavorable as the prognosis is, nevertheless, as I have already reported, there are cases which terminate in recovery after a prolonged febrile course. Only lately I have seen a case of this kind in which the fever continued nearly seven months and in which there was insufficiency of the aortic valves in addition to rheumatic affections of the joints. Finally the fever gradually ceased and the patient is in a tolerable condition. As a matter of course, the general conditions to which I refer above, must also be considered in the prognosis of valvular lesions. Age, sex, constitution and nutrition, character and intelligence, are also not devoid of importance, in a greater or less degree, for prognosis. In brief, a great variety of conditions, which not alone influence prognosis, but at the same time indicate the danger which the patient runs, and thus point out the ways and means to avoid such dangers and disturbances, and, on the other hand, seek the favorable influences, and make them effective.

I now come to the stage of disturbed compensation, in which the conditions for compensation that have developed in the diseased heart no longer act completely. To the physician this stage is by far the most important, more important than the stage of complete compensation, inasmuch as in the latter we can only act in a prophylactic way, by prescribing the suitable mode of life, while the stage of disturbed compensation requires the cautious activity of the physician. In view of the manifold character of the symptoms and their significance in

the stage of disturbed compensation, it is advisable to distinguish several phases:

1. The phase of mild disturbances of compensation, which consists in the fact that the patient is no longer as capable as a healthy individual; that he is more apt to suffer from dyspnoeal disturbances, palpitation, perhaps slight stases in the lungs, slight attacks of hæmoptysis. With a few restrictions, however, he may still live like a healthy individual. He may be active and enjoy all the pleasures of life in proper measure.

2. The second, more severe phase, is characterized by the occurrence of dropsical symptoms. These entail a graver prognosis, but are by no means absolutely unfavorable. This stage also lasts for a longer or shorter time with many variations.

3. The third phase, in which the prognosis is desperate, is characterized by severe dropsy, which no longer disappears under any treatment; by marked dyspnoea, so that the patient is no longer able to do anything, and by the other sequelæ of stases in the liver and lungs. Even in this stage the end may be somewhat deferred by treatment or by the forces of nature, but we can no longer expect decided and permanent improvement, and can only delay the catastrophe. The end occurs either from the results of dropsy or from a sort of a uræmic condition with delirium, or from paralysis of the heart (asystoly) or, finally, from complications on the part of the lungs, kidneys, or brain. In contradistinction to this latter phase, the second form offers a wide and not unfavorable field for the activity of the physician and furnishes by no means always an unfavorable prognosis. The first phase affords most room for the hope that we can succeed in again compensating the disturbances, and securing to them compensation for a longer period. But even the second (dropsical) phase by no means excludes in all cases the hope of complete restoration of compensation. At all events it may be hoped that the disturbances will disappear temporarily and the continued advance of the disease be materially delayed.

In the individual case the prognosis must depend upon the intensity of the sequelæ. The more advanced the stage of disturbance of compensation, the more difficult will it be to restore the compensation completely for any length of time. Then, the intensity of the changes in the heart itself, which

permit an inference concerning the intensity of the heart lesion, must also be considered. Thus, an aortic insufficiency, with pronounced dilatation of the left ventricle, will furnish a more unfavorable prognosis than another with slighter dilatation. The affected valve and the nature of the endocarditic process, as remarked above, must also be considered.

Of great importance in the prognosis is the condition of the heart muscle. This is determined essentially by the tension and frequency of the pulse, the character of the renal secretion, the degree of dyspnœa.

A practically very important question is whether the present disturbance of compensation or the exacerbation of former disturbances have developed gradually, without any special cause, or from the presence of factors which may be removed and relieved. In such patients we not infrequently see a very decided aggravation of the condition by an intercurrent bronchitis, pleuritis, pneumonia, etc. But if we succeed in overcoming this danger, the old favorable condition may again return. This is also true of the action of pregnancy, to which I have previously referred.

Finally, the prognosis depends upon the efficacy of drugs. As we possess a large number of drugs and curative methods, we will choose another when the patient no longer reacts to one remedy. According as the patient reacts well to one of these remedies the prognosis improves. Sometimes it is a matter of accident to find that drug which has a good effect. In general we can expect success so much the less when the patient has already been treated with caution by all suitable remedies—so much the more, the less therapeutic aids have been exhausted. This is also true of the dietetic, mechanical methods of treatment. Öertel himself states that, in cases in which no increase of the renal secretion can be obtained by limiting the ingestion of fluids and in which the difference between the absorption and discharge of fluids amounts to fifty per cent, the outlook for the success of these methods of treatment is very unfavorable.

III. With regard to the different relations of the size of the heart, its hypertrophy, dilatation, and diminution, I have already spoken sufficiently—but I must add a few remarks with regard to the prognosis of heart murmurs. Systolic and diastolic murmurs in particular must be kept distinct in this

respect. Systolic murmurs offer the best prognosis, both in regard to their recovery as well as to the other disturbances in the heart. In the first place, they are often non-organic in their nature, although endocardial in their development, as may happen without organic disease of the organ. They are partly blood murmurs, partly accidental murmurs, or also systolic pulmonary murmurs. In one of the last numbers of the New York "Medical Record" is found a table of examinations by Dr. Morton Prince, of Boston, who carefully examined for cardiac murmurs seventy-seven individuals suffering from no cardiac symptoms, and in twenty-five found a systolic murmur, that is, in a third of the cases. These conditions *per se* necessitate a favorable prognosis for systolic murmurs. Even those which must be attributed to diseases of the heart permit a more favorable prognosis than other cardiac murmurs. Although I hereby mean to imply that systolic heart murmurs, without other symptoms of a heart disease, cannot be at once regarded as signs of a cardiac affection, nevertheless, I desire to warn you, on the other hand, against neglecting them under all circumstances. Here, also, everything depends upon the other conditions, especially the age of the patient. At an advanced age, blood murmurs, anæmic and other accidental murmurs, are rare; the organic murmurs more frequent. In this respect there is also an essential difference between the systolic murmurs at the apex and those at the aortic orifice. The former are often accidental; the latter very rarely; and in older individuals enable us to infer sclerosis of the aortic valves or dilatation of the ascending artery.

The matter is entirely different in diastolic and pre-systolic murmurs, which, with very few exceptions, permit us to infer an organic change in the heart. Accidental diastolic murmurs which occur without other cardiac symptoms and again disappear, are extremely rare, so that they need not be considered in the prognosis. The only exceptions are the venous murmurs in anæmic individuals, which are heard below the manubrium sterni and which are sometimes of a distinctly diastolic character. As a rule their differentiation from the diastolic endocardial murmurs is not difficult, with a little care. Their significance is similar to that of the anæmic venous murmurs.

I will now mention a few abnormalities of rhythm: inter-

mittences, and arrhythmia of the most varied kinds. The patients are especially terrified by the intermittence of a pulse beat, followed, as a rule, by a more vigorous pulsation and extremely disagreeable feeling. Nevertheless, this symptom has no serious significance and does not depend upon an organic lesion of the heart. It is found in healthy individuals, in febrile, young and older persons. It depends most frequently upon reflex irritation in the abdomen (irritation of worms in children) and upon mental excitement which has lasted for some time. Of still less significance are the arrhythmias which consist, not in intermittence, but in irregularity of the heart's action. According to my experience, these phenomena are usually of an individual nature. In some persons they occur often without special cause, and I have known such patients in my practice in Koenigsberg, who suffered from irregular pulse during their whole life. As a matter of course, these facts do not exclude the occurrence of intermittence, as well as of arrhythmia, in heart disease, and other notable affections, but this symptom has no grave significance, and therefore admits of a favorable prognosis—perhaps not entirely good with regard to recovery, because arrhythmia often becomes habitual—but, at all events, with regard to any possible danger. Nor am I aware that in the course of heart disease arrhythmia has any material influence upon the prognosis. It decides nothing, even when it is observed in the later stages. A more important condition is delirium cordis, an arrhythmia which is so considerable that the rhythm can no longer be distinguished. The name was first introduced among us by Traube, but is found at an earlier period among the French writers, who speak of “*délire du cœur*” and “*folie du cœur*.” Allied to this is another symptom, called tremor cordis by the older physicians—that is, the contractions of the heart are either so irregular, or so feeble or incomplete, that the hand when applied to the heart seems to feel a trembling of the organ. Both of these irregularities are much more important than those previously mentioned. Delirium cordis, if at all marked, cannot be tolerated for a long time, but leads to circulatory disturbances which threaten life. I remember a case in an old man, in whom, as the result of psychical excitement, delirium cordis, with anxiety, had developed, and severe disturbances of circulation, with dropsy, were the result. For some months the

patient was very ill, but recovered completely. Slight irregularity of the pulse continues to the present time. Tremor cordis, inasmuch as it indicates a frequent and feeble heart's action, is naturally a symptom of grave significance.

In conclusion, I will mention the symptoms of changed frequency, tachycardia and bradycardia. The former indicates conditions of considerably increased frequency of the pulse. This also presents a threatening character. Physiologically we consider it as a condition in which the pneumogastric nerve is either paralyzed or approaching paralysis. We know that the condition of the pneumogastric of the heart of higher animals, for example, the dog, will produce such tachycardia. This is not always directly fatal. It may be borne for a long time, but is nevertheless associated with danger to life. The question, how long such a paralysis of the pneumogastric may be tolerated, is answered with difficulty, because other disturbances, as the result of the deviation of the nerve, also appear in the operated animals. According to the physiological doctrine, we assume that the regulating nervous system of the heart which is situated in the pneumogastric, has the effect of saving the heart's action in such a way that a paralysis of the pneumogastric is able to use up the power of the heart. *Per se*, it may be said that in a rapid action of the heart the work which the organ performs has not become greater—that is, the blood is merely propelled in the normal manner—but the diastoles are shortened, and then the nutrition of the heart is impaired. Indeed, it is not improbable that a frequency of 120 or 150 contractions requires a greater consumption than one of 60 beats, although both only perform the same work. Without deciding the question here I accordingly come to the conclusion that the generally entertained medical opinion is justified, namely, that a high frequency of the pulse consumes the heart and therefore entails danger to life. In the individual case, however, the limit at which the dangerous exhaustion must occur cannot be determined. Under certain circumstances the heart tolerates astonishing conditions in this respect, and we are unable to say what limit can no longer be tolerated, nor how long, in individual cases, such abnormal frequency can be borne. As a general thing, a frequency of more than 120 must be regarded as a serious symptom, but there are cases in which a frequency of 140 to 160 is tolerated

for a long time. In my article on sclerosis of the coronary arteries I have reported a case in which the patient, who suffered from angina pectoris and weakness of the heart, had a pulse of 140 for four weeks. This is extremely rare. The frequency did not diminish, but rather increased to 160, and the patient died with severe heart symptoms and delirium. Finally, we observe remarkably high frequency of the pulse in Basedow's disease, in which a pulse of 120 is considered small, while the patient hardly feels the palpitation. It is only when the frequency reaches 140 to 160 that we become somewhat alarmed, and, so far as my experience goes, danger is present at those limits and the prognosis becomes dubious. In one case I even observed a frequency of 200, in a woman who had suffered for years from Basedow's disease, but only experienced this high frequency of the pulse for a short time. She died a few days later.

Febrile tachycardia is an important symptom. It is the ordinary practical view that a frequency of the pulse of more than 120 in fever makes the prognosis serious. On the whole this statement is correct, but marked differences must be considered. In acute exanthemata a very high frequency is the rule; 120 to 130 in scarlatina of young people has by no means a serious significance, while the same frequency in adults is dangerous. The frequency of the pulse plays a specially important part in pneumonia, and Dr. Fraenzel, in a lecture on pneumonia, has justly stated that in this disease the high frequency of the pulse is more important than respiration. During this winter I saw two cases in which the frequency of the pulse exceeded 160, and yet recovery occurred. But in two other cases, with the same frequency, death set in, although the other symptoms of the pneumonia were confined within moderate limits. Allied to this is the occurrence of high frequency of the pulse in the third stage of meningitis (120 to 160 beats), which depends upon the direct paralysis of the pneumogastric, and has an immediately fatal significance.

I will also mention paroxysmal tachycardia (Gerhardt, Nothnagel, and others), a very interesting disease, of which I have seen quite a number of cases. It consists in the fact that patients from time to time, usually as the result of some excitement, or from excess in drink, but occasionally without any special cause, are attacked by remarkably violent palpita-

tion of the heart. I recently observed a case of this kind in the Charité, in a peddler who endured much bodily and mental strain, and who entered the hospital with a frequency of the pulse of 160 beats. The attack lasted six days; then the pulse sank nearly one-half. A few days later a similar attack occurred, and again lasted for several days. The majority of cases of paroxysmal tachycardia are similar. The prognosis is not bad, because the high frequency of the pulse is only temporary. Moreover we know from the former attacks that the patient tolerates this frequency well. So far as my knowledge goes, we have to deal chiefly with nervous, especially psychical, influences, or with severe alcoholic excesses. Allied to this is the acceleration of the activity of the heart by psychical impressions, terror, fright, which we observe particularly in the female sex, and which is unattended with any special danger. The tachycardia of convalescents may also attain a high degree. Convalescents are often attacked on the slightest mental or bodily excitement, by high frequency of the pulse, with a feeling of oppression and syncope.

Considerable slowing of the pulse (bradycardia) is a rarer symptom. Moderate slowing, which *per se* has no notable prognostic significance, occurs, for example, in convalescence, also in jaundice, etc. In practice, slowing of the pulse is justly regarded as a symptom of feeble heart's action and is prognostically and therapeutically important. From it we draw the indication for cautious stimulating treatment in which digitalis is usually not to be employed. More pronounced slowing of the heart's action is observed after the use of digitalis, and in angina pectoris. I remind you of the investigations of the late Dr. Samuelson, of Koenigsberg, and Schultheiss-Rechberg, who had worked under Cohnheim. Both experimental investigations are not entirely in harmony with one another, but both furnish the result that ligation of the coronary arteries, especially of the left, produces considerable diminution in the frequency of the pulse, which in some cases even falls to eight per minute. The frequency of the cardiac contractions also falls considerably after prolonged use of digitalis. This can be observed in the most exquisite manner in cases of angina pectoris and dilatation of the heart, myocarditis fibrosa. We then notice, as I have shown in my article on sclerosis of the coronary arteries, a diminution of the

frequency of the pulse to 32, even to 24 beats, as a rule, in such a manner, that after a strong heart beat accompanied by a distinct arterial pulse (radial pulse) there follows rapidly a second feebler heart beat which does not correspond to a perceptible radial pulse. Now follows a longer cardiac diastolic interval. This phenomenon of ictus cordis bigeminus is in itself of great interest, which is increased by the fact that, as it appears, it gave rise to the discovery of the action of digitalis. This remedy celebrated its jubilee two years ago. According to an article which I found at this time in an English journal, it was first a secret remedy against dropsy, until the Scotch physician Withering determined to find out the active ingredient in this remedy. He recognized as such digitalis (then called foxglove) and discovered the pulse-slowng action of this classical drug. At the same time he describes a case of heart disease in which considerable improvement occurred after the use of digitalis, and the pulse also fell to 32 beats. I infer that he had to deal with a case of dilatation of the heart as the result of myocarditis fibrosa.

The last form that I will mention is permanent bradycardia, those remarkable and not sufficiently explained cases in which the frequency of the pulse in an individual sinks quite suddenly, as it seems, to 30, 24, or even 20, and remains at this height permanently with very slight variations. As is well known, Stokes was the first to describe these cases with the accompanying epileptoid attacks. He attributes the affection to sclerosis of the coronary arteries. From further observations, however, of which only a small number have yet been made, it appears that this assumption holds good only in a few cases, in others, this lesion cannot be assumed. The disease is observed chiefly in old people, but also in men in the best years of life. The prognosis has hitherto been quite uncertain. There is a decided predisposition to attacks of dizziness, syncope, and even to a sudden fatal termination, particularly in old people. Nevertheless, such patients may live for a long time, and feel tolerably well. I have known for ten years a Berlin gentleman who goes about with a frequency of the pulse beats of 24, and now, hardly 20, and, apart from occasional attacks of dizziness, feels in good health.

My review is now finished. I beg pardon if I have strained your patience too long. Much could have been expressed,

perhaps, more precisely; some matters perhaps more exhaustively; some more briefly; but complete exhaustion of the subject in all directions could hardly be attained. In conclusion I will make two remarks. In the first place I wish to emphasize that it has been my endeavor to discuss the prognosis, not alone in so far as it may be termed a good or a bad prognosis, but I have devoted more attention to the cases which entail an uncertain prognosis. The field of doubtful prognosis is the real field for the activity of the physician. When the individual is struggling with this disease and its sequelæ, when the termination is doubtful—there lies the real activity of the physician and the medical art. Here the physician may not idly fold his hands and confine himself to the rôle of an observer. He also must enter the combat, must fight the disturbances and dangers and make use of the favorable conditions which are presented for the patient according to the best of his endeavor. He must fight with all medical remedies and for the cure, or at least the favorable course, of the disease.

Secondly, although I dealt only with the prognosis of diseases of the heart, I could not avoid, nor did I wish to, touching in certain places upon treatment and calling attention to those conditions in which therapeutics could take a part, and where at the present time we find new problems for our therapy. In this respect I mention the progress which the treatment of diseases of the heart has made in the last few years, partly from the introduction of new drugs, partly from the dietetic, gymnastic methods which, in a certain sense, have induced a reform in this field of therapeutics. Although the discussions still continue, and the results and indications are not yet clear on all sides—and this is not to be wondered at, in view of the complicated objects in internal therapeutics—nevertheless, we have undoubtedly made a decided advance. We find with grateful satisfaction that internal therapeutics, as in other fields, has not stood still in the department of diseases of the heart; that, free from dogmas and foreign authority, it pushes its own way, and, conscious of its final and chief purpose, causes medical activity to become more and more fruitful and useful. Without claiming that we effect miracles and that we can reverse the laws of healthy and diseased life, yet we can look back with satisfaction upon the results of in-

ternal treatment and of the medical calling. We are justified in refusing the pessimism which long bore heavily upon internal therapeutics, and whose sources are found, on the one hand, in unjustified modesty and timidity, and, on the other hand, in an insufficient knowledge of what is to be effected, and can be effected, by internal treatment.

THE SPUTUM.

A Contribution to Clinical Diagnosis

AND

PRACTICAL EXAMINATION FOR TUBERCLE BACILLI.

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THE SPUTUM.

CHAPTER I.

DEFINITION AND DIAGNOSTIC SIGNIFICANCE OF THE SPUTUM.

THE appreciation of the sputum with regard to its diagnostic and prognostic significance for affections of the respiratory organs may be historically traced back to the beginning of medicine.

The views of Hippocrates and Galen concerning the sputum must be considered as having been the dogmatic property of physicians for centuries. They are characterized by keen powers of observation, in so far as they are not influenced by humoral-pathological errors and philosophical speculations.

During the middle ages and until the seventeenth century, there could, of course, be no thought of newer views; even in the eighteenth century the humoral pathology of ancient times still found credence among the majority.

A new epoch for estimating the importance of the sputum from a diagnostic standpoint dawned with the beginning of the present century, when great advances were made in pathological anatomy, and physical diagnosis was introduced in the study of respiratory diseases. Chemistry and microscopy were soon added as diagnostic handmaidens. The limits of observation were enlarged by the work of Henle, Virchow, Traube, etc., as well as by microscopical and chemical inquiries. But above all new points of departure were opened for us by microscopical investigations, combined with bacteriological technique, the utilization of which has been of the utmost importance in the diseases of the respiratory apparatus. Even

though the investigation of the sputum for certain diseases has not been established so firmly as to serve for an absolute criterion—as, for instance, a certain amount of reserve is still necessary in deciding the infectious nature of pneumonia from the character of the sputum—yet the mere fact that we are enabled, at a time when other diagnostic evidence is wanting, to characterize a lung disease as unquestionably of a bacillary nature, should suffice to demonstrate the very great value of the investigation of the sputum in clinical diagnosis. Continued studies in this field of diagnosis will not permit microscopical and bacteriological sputum-culture to take an inferior place among the clinical methods of investigation.

Since the time of the monograph of Biermer¹ in 1855, no comprehensive treatise on the sputum has appeared. It, therefore, appeared to me timely to classify the results obtained in this field in the last few years, since it seems to me they have not been estimated as they deserve, in order that the practitioner might make himself thoroughly acquainted with the subject in a short time.

I thought myself the more justified in this determination, because the copious clinical material at Rehburg gave me special opportunities for cultivating this branch of diagnosis.

As regards the engravings, it should be stated that Figures 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, and 14 were drawn from my own preparations by Mr. Otto Peters, academical painter and draughtsman of the University of Göttingen, with his accustomed accuracy, for which I hereby extend my thanks; Figs. 5, 6, 13, and 15, are borrowed from Eichhorst's "*Handbuch der Untersuchungsmethoden*," Flügge's "*Micro-organisms*," and Eulenburg's "*Encyclopædia*."

I request the indulgence of my confrères for some of the imperfections, of the existence of which I am aware, especially in the bacteriological portion of this essay, and solicit their kind criticism.

In general we consider the sputum the product of the secretions of the mucous membrane of the respiratory apparatus, from the opening of the oral cavity to the finest bronchial twigs.

A differentiation into laryngeal, bronchial, or pulmonary sputum cannot be effected, so long as we are unable to deter-

mine with certainty the origin of the expectorated masses brought to our notice.

When the sputum consists of the secretion of the respiratory mucous membrane, formed under the usual physiological circumstances, it is to be designated as normal; when, however, it is composed of products determined by a local inflammatory process, we speak of it as a pathological sputum; if it contains micro-organisms, which by culture and inoculations can be shown to possess pathogenetic properties, an infectious sputum will also have to be differentiated.

Phthisical sputum may be classed as a special representative of this class.

The examination of the sputum has become one of the most valuable and not infrequently decisive aids in clinical diagnosis. "It brings to light substances as carriers of pathogenic products which are developed in the invisible well-springs of disease" (Biermer).

The sputa warrant us in procedures which we would not resort to at all, or do so at too late a period, after other methods of diagnostic investigation. Proof of this is apparent, among other things, in the discovery of elastic fibres at a time when physical exploration fails to give evidence of the destruction of pulmonary tissue; but the most decisive instance, and at the same time one of the utmost practical importance, is the demonstration of the bacilli of Koch.

The spit-cup and the microscope, relegated to a secondary place in respiratory diseases by percussion and auscultation, have thereby become indispensable.

The value of the momentous discovery of Koch² to the practice of medicine consists, for the present, in the incontrovertible proof that a bacillary process is taking place at some portion of the respiratory tract whenever we find the bacilli of Koch in the sputum. The nature of those affections which formerly were not recognized as so-called tuberculosis—and probably could not be so recognized, because the clinical picture, which their course presented, more frequently simulated that belonging to other affections—is particularly made clear to us by this means. I call to mind in this regard the so-called "innocent" catarrh, the catarrh of the apices, "which require for their cure only a journey into the country or to the mountains;" the variable, apparently gastric and chlor-

otic disturbances, the well-known cases of initiative hæmoptysis, pulmonary syphilis, laryngitis, bronchiectasis, etc. The presence or absence of the Koch bacilli in all these diseases establishes the diagnosis, determines the prognosis more or less, and prompts us, by reason of practical experience and a knowledge that not every bacillary affection must inevitably have a fatal termination, to take such steps, provided it is not too late, as are capable of healing the cavities and eliminating the parasites. I have frequently had the opportunity of noting the serious consequences which followed such errors in diagnosis, in cases of consumptives who were treated for pulmonary syphilis (?) with antisypilitics, with sweat-cures, vapor-baths, etc., and who were then sent to Rehburg to improve their reduced conditions.

The discovery of bacilli in the sputum removes every doubt. I have had numerous similar experiences in so-called stomach-cough, chlorosis, "colds," etc., and could illustrate them by innumerable histories. I was once enabled to diagnosticate, by means of the sputum, an acute tuberculosis which presented the picture of typhoid fever, and which ended fatally on the ninth day. Analogous data were obtained in doubtful cases of laryngeal syphilis and phthisical ulceration. Testing the expectoration, or eventually removing it from the larynx by means of a brush or sponge, will always definitely decide the question. "Of course a reliable and decisive diagnosis can be made only by him who possesses a good optical apparatus and is a practised microscopist, and who can devote the necessary time to the investigation, otherwise the whole procedure is valueless. This is not, and cannot, be everybody's task, and we therefore have to content ourselves, in practice, to advise those who have not the requisite qualifications, to seek assistance as soon as possible from a competent source in every doubtful case" (Ewald³). With sufficient patience and skill, it is hardly possible to miss the bacilli; according to Gaffky,⁴ they are present in ninety-seven per cent of the examinations. I arrived at the same result in my independent researches, which embraced more than one thousand cases. It must not be forgotten that, even in ulcerative affections of the pulmonary tissue (cavities), the bacilli need not be demonstrable in the expectoration day after day—a fact noted also by Koch⁴; that a *transient* freedom from parasites may

occur when the communications with the bronchi are either temporarily closed by tough plugs of secretion, or merely the spores are present, which attain further development only under favorable circumstances.

Notwithstanding that such cases are to be regarded as rare exceptions, we should derive the hint from them not to base a positive diagnosis upon a single investigation of the sputum.

CHAPTER II.

GENERAL TECHNIQUE OF THE EXAMINATION OF THE SPUTUM.

THE examination of the sputum consists of two parts, of which the one supplements the other in equally valuable degree—the macroscopical and the microscopical. The macroscopical test must necessarily precede the microscopical, or we should be guilty of great negligence, which frequently enough shows itself by inaccurate and negative results; despite its incompleteness, the former method will often give us very useful diagnostic landmarks.

We first scrutinize the appearance of the whole expectorated mass (the sputum of the previous night and that first voided in the morning) with regard to color, consistence, and transparency, and in general seek for pathological products, such as blood, pus, etc., according to their quantity and various sources. If it be made a principle to make our examination of the substance not alone as it is voided in the vessel for its reception, but to distribute it as thinly as possible over a preferably blackened plate or black paper, we shall not be likely to overlook important admixtures, and will further be enabled to distinguish indifferent matters, as bread crumbs, fibres of meat, etc. For some cases, as in those in which we seek for coagulated fibrin or elastic fibres embedded in the mucus, it is advisable to agitate the sputum in water in a glass cylinder; after removal of the water the parts may be more readily isolated from the sediment; however, I may remark that for microscopical examination it is not desirable to have the patient expectorate into water, as some elements become altered or dissolved by its action.

Each macroscopically distinct part is now to be examined under the microscope. For this purpose it is to be “teased” with platinum needles in glass handles, which must be sterilized at white heat before use; as small a particle as possible is detached and transferred to a cover-glass. It is here to be spread out in the thinnest layer, by being either sep-

arated with the needles or pressed between two cover-glasses, which are to be gently drawn apart, not lifted. Additional fluid for dilution is generally superfluous; when employed, a 0.75% saline solution or sterilized distilled water suffices.

The microscopical scrutiny at first consists of a low power (60 to 80 diameters); after this the different portions of the preparation are viewed under a higher power (500 to 600 diameters), and eventually, when schizomycetes are sought, with immersion lenses, and more accurately analyzed. If dry preparations are to be made, we must proceed in the manner described for the Koch bacilli (page 118).

Of reagents and staining fluids which are generally employed, the following may be mentioned:

1. Acetic acid, generally a $\frac{1}{2}$ –1% solution; in many cases the preparations are clarified and rendered more transparent by this substance; nuclei, fat-cells, and micro-organisms are made to appear more distinctly; elastic fibres are resistant to the action of the acid.

2. Potash or soda-lye. For most cases a 1 to 3% solution is used. By these the cells are also dissolved, but the elastic fibres resist, as well as the fats, spores, and schizomycetes. In a 33% solution the form of the red blood-corpuscles is preserved, while they disappear in more dilute solutions. Both reagents are above all valuable in the diagnosis of micro-organisms which are not affected by them; the colonies of micrococci known as zoöglæa, particularly are made more pronounced in appearance, and the forms of single individuals, rods, etc., are accurately characterized.

3. Solutions of aniline dyes. Of these, I use almost exclusively a concentrated alcoholic solution of gentian violet (20–25 gm. : 100 alcohol), which is properly diluted by aniline-water. In the event of a probable double staining, I have at hand a concentrated aqueous solution of vesuvin, which is preserved from moulding by the introduction of a small piece of camphor, and may be kept for quite a long time. The quantity necessary for each use is to be filtered through a moist medium.

Aniline water ($\frac{1}{4}$ aniline, $\frac{3}{4}$ distilled water) is to be always freshly prepared by shaking for a minute in a test-tube.

4. Compound iodine solution (iodine 1, iodide of potash 2, distilled water 300). For employing the Gram method for isolated staining of schizomycetes.

CHAPTER III.

THE CONSTITUENTS OF SPUTUM.

PUS-CORPUSCLES (WHITE BLOOD-CORPUSCLES).

PUS-CORPUSCLES, besides blood serum, fibrin, and albumin caused by transudation from the vessels, are the physiological products of inflammation, and, according to the researches of Cohnheim, are to be regarded as white blood-corpuscles which have emigrated from the blood-vessels in large quantities; they therefore also possess the same dimensions. The protoplasm of pus-cells is partly impregnated with finer and coarser granules, and partly, as it were, dusted over with these bodies; numerous nuclei, often three or four, are embedded in the protoplasm, which in a fresh condition of the cells are generally covered by the granules, and therefore but dimly visible; only after the latter have been made to disappear by the addition of dilute acetic acid, do they become clearly defined and recognizable. Dead cells are round and immovable, and frequently contain finely granular matter originating in fatty metamorphosis. This increases the opacity and causes the yellowish tinge of the sputum.

MUCOUS AND SALIVARY BODIES.

These are round cells similar to pus and lymph cells, of a cloudy but not granulated appearance, with one or two roundish nuclei, and granular contents. The salivary bodies come mostly from the submaxillary and sublingual glands, and in the course of their exit become associated with the sputum. In fresh living cells, their granular contents, under a more powerful lens, show a peculiar-amœboid phenomenon, a distinct "dancing" of the granules. This motile property, similar to the so-called Brownian molecular movement, has so far been unexplained; however, it is not a vital manifestation originat-

ing in parasitic organisms, which could in this manner simulate spontaneous movement; it is a purely physical phenomenon; for this reason, it is impossible to stain the granules with aniline dyes.

EPITHELIUM.

The two chief groups found in the sputum are pavement and cylindrical epithelium. They constitute a normal admixture from the mouth and respiratory tract. Pavement epithelium—so-called from its resemblance to the stones of street paving—is the product of the oral mucous membrane, the tonsils, the tongue, the salivary glands, a portion of the larynx (the vocal cords), and the small bronchial glands. Their origin may be suspected from their size and shape. The large, flat, usually irregularly hexagonal cells, occurring isolated and cohering in larger patches, come from the oral cavity. They undergo a peculiar transformation in form and by chemical combination (keratin)—a so-called cornification—by which they become broader and flatter, and the normally large and vesicular nucleus and one or more nucleoli become less distinct and smaller and disappear. By the addition of a 5% potash solution we can cause them to swell up and resume the tessellated form. They are generally surrounded by a dark wide mass, which under a higher power appears as heaps of schizomycetes (cocci). In catarrhal conditions of the mouth and pharynx, ptyalism, etc., the sputum contains them in large quantities and thereby gains an increased opacity and flocculant appearance. (See Figs. 8 and 9.)

The smaller pavement epithelium is principally excreted from the bronchial mucous glands in bronchial affections, but otherwise shows similar properties. No especial diagnostic importance attaches to these formations.

The second form, cylindrical epithelium, the simple as well as the ciliated, is far less frequently found in the mucous portions of the sputum, notwithstanding that the entire respiratory tract, from the larynx (with the exception of the vocal cords) to the finest bronchial twigs, is furnished with ciliated cells; this may be due, as surmised, to the firm insertion of these cells by root-like processes. When found in the sputum, it generally comes from the nasal mucous membrane or the posterior surface of the velum palatinum; according to the

view of Biermer, this may take place in those individuals who have the inelegant habit before expectorating of bringing the mucus from the palate together with the sputum by an inspiration (nasal screatus), in such cases not infrequently the movements of the ciliæ may be observed in freshly voided sputum; according to an interesting experiment of Virchow, the ciliæ may be re-animated, after they have ceased to move, by the addition of very dilute alkalis. They are not essentially changed in contour by the expectorated substances.

So far no agreement has been arrived at concerning the nature and significance of a third form of epithelium in the sputum, the so-called alveolar epithelium. These round cells resembling epithelium are found in almost all sputa. They are from two to four times as large as white blood-corpuscles, and are further distinguished by a sharp spheroidal contour, a vesicular nucleus with granular contents, and one or more nucleoli (Fig. 11). They take on a spherical shape by endosmosis during inflammatory processes. Buhl⁵ regarded these bodies as desquamated pulmonary alveolar epithelium, and their presence warranted him in diagnosing a beginning phthisis. According to the researches of Guttman and Smidt⁶ and Bizzozero,⁷ and in my own experience, they are not absent in any affection of the respiratory apparatus, not even in simple bronchial catarrh, and in the early morning sputa of apparently healthy individuals.

The pathological degenerative changes which affect all cells are not lacking in this variety of epithelium. The alveolar cells are most frequently subject to fatty metamorphosis, which destroys them; the nucleus becomes completely covered by the round, sharply refracting fat granules—fat granule cells, which then become masses of fat aggregation and finally are changed into structureless detritus.

In addition, myeloid degeneration is a characteristic feature of these cells (mixture of the fatty acid with an alkali), through which homogeneous, dull, or nacreous, glistening granules become embedded in the cells, which for purely extrinsic reasons have been called "myelin granules." By treatment with 0.1% osmic acid, they take on, like the fats and nerve axis-cylinder, a deep black color by reduction of the metal; the reaction occurs in a few minutes; they probably have no diagnostic significance.

Black pigment is quite frequently found in the protoplasm of the alveolar cells, in the form of minute dark-brown or deep-black granules very resistant to chemical influences, the value of which has been greatly overestimated or erroneously explained by earlier investigators; the pigment also occurs in greater quantities freely scattered about (Fig. 8). Morgagni considered black sputum as a symptom of beginning phthisis. It may be recognized macroscopically in the mucous portions of the sputa, appearing as gray or grayish-black particles, and as such are frequently distributed throughout the expectorated mass. These formations consist of those particles of dust or soot which gain access to the mucous membrane of the respiratory organs during inspiration, and may afterward be carried into the interstitial tissue of the lungs and the lymph channels by means of amœboid cells. This pigment is to be found in almost all individuals, varying in quantity according to position in life and occupation.

I observed it in the greatest profusion in the sputa of a saddler who suffered from chronic bronchitis, and who, during his stay at Bad Rehburg, expectorated this black matter for weeks at a time. Although in this case the bacilli of Koch were never found present, we must recognize, according to Koch's investigations regarding the quantitative presence of fungi in the air, that in a predisposed individual these dust particles could, *cæteris paribus*, be the vehicles of infection.

This black pigment can be readily distinguished from the genuine (that is, originating in the organism) brownish (not black) pigment, which rarely exists in the sputum and which depends upon a transformation of the coloring matter of the blood (hæmatoidin), as a sequence of preceding hemorrhage or stasis in the pulmonary venous system with diapedesis of red blood-corpuscles and pigmentary transformation of the latter; this condition is prone to complicate certain cardiac diseases.

RED BLOOD-CORPUSCLES.

In a few diseases of the lungs and mouth the red blood-corpuscles give the predominant characteristic to the sputum, and become mingled with it during expectoration. Their presence is macroscopically recognizable by its color, and this again is dependent upon the thoroughness or otherwise of

the admixture. The sputum to the unaided eye may appear spotted with red color and permeated with puncta and streaks, or by more intimate mixture it may appear yellowish-red, or light red after severe hemorrhage, or of dirty red, or rusty like prune-juice color after longer sojourn in cavities, etc. In the course of this work I shall refer to this matter more in detail.

Microscopically, the blood-corpuscles normally appear as the well-known biconcave discs, with a central depression marked by shading, a sharp contour, and yellowish-red color. If the sputum has stagnated for some time in the respiratory tract before expectoration, the position which the blood-corpuscles occupy strikes the observer; they do not as usual adhere by their flat surfaces in the form of rouleaux of coin, but by their borders. Biermer sees the cause of this in the fact that "the blood-corpuscles are separated during the mechanical act of expectoration, becoming, so to speak, soiled by mucoid or other expectorated matters, and thereby are less adapted to readhere to one another."

If bloody sputa be allowed to remain immersed in water for some time, the corpuscles become spherically swollen, shrunken, or decolorized, and perish; they can no longer be demonstrated by the microscope, notwithstanding that the yellowish-red color has been preserved by the hæmoglobin remaining.

ELASTIC FIBRES.

Their presence is always dependent upon destructive processes in the pulmonary parenchyma or the bronchi. Overlooking those isolated cases of ulcerative bronchitis or pulmonary abscess in which elastic fibres are found in the sputum, we must consider them as the product of necrosed tissue of the lungs and bronchi, induced by the action of Koch's bacilli. The severity of the affection may be measured by the quantity of fibres present; we may also approximately determine their source by the form under which they appear, they are, for instance, finer and more longitudinal in phthisical laryngeal ulcerations than the bent and twisted lung fibres. According to Dettweiler-Meissen,⁸ they occur in more than 80% of phthisical affections, and, from my rich experience, I can in general coincide with their statement that where elastic fibres

exist, the bacilli of Koch are also present. The presence of elastic fibres, which formerly was regarded as the most significant and positive criterion of pulmonary phthisis, must now, since Koch has given us an indisputable test in its place, be regarded merely as a diagnostic auxiliary.

With a little practice one is enabled even in the macroscopical examination of the sputum spread out in a thin layer, to surmise the existence of elastic fibres in the opaque dirty-white or reddish-yellow particles, which appear like bread-crumbs to the unaided eye. For the microscopical examination, the darkest spot is removed by means of two platinum needles and pressed between two cover-glasses; it is to be remembered that the elastic fibres have a tendency to be displaced toward the edge of the cover-glasses when pressed upon, in which situation they may be readily found. By the addition of dilute solutions of potash or strong acetic acid, which the elastic fibres are well known to resist, the remaining image is destroyed and the fibres appear the more distinctly prominent. If the entire expectorated mass is to be tested for elastic fibres, the sputum should be thoroughly agitated in double its quantity of distilled water, allowed to stand for twenty-four hours, carefully decanted, and after filtration, the precipitate examined; or the sputum may be boiled in a test-tube for several minutes, after the addition of an equal quantity of potash or soda lye, three or four times the quantity of water poured over it, and after twenty-four hours' standing, examined with the microscope under from 300 to 400 diameters. The double contour of the fibres prevents mistaking them for cotton fibres; in order not to mistake needles of fatty acids for elastic fibres, gentle heat should be resorted to, which melts them and transforms them into small globules.



FIG. 1.—Elastic fibres with pus-cells, finely granular detritus, and a large epithelial cell with nucleus from phthisical sputum. (Author's observation.)

FIBRINOUS COAGULA.

These formations, already described by the oldest observers as bronchial or fleshy polypi, were accorded their true position

in 1845 by Remak.⁹ According to him, they are a product of inflammation, and appear, when the sputum is thrown upon water, as macroscopically visible, large or small grayish-white masses, more frequently composed of filaments rolled together; they form from the exudate by means of fermentative influences (death of white blood-corpuscles, fibrin ferment), and apply themselves loosely to the mucous membrane. We observe them in three forms of disease: croup, fibrinous bronchitis, and



FIG. 2.—Large bronchial coagulum from the sputum of a man *æt.* 54, having a healthy appearance and good appetite, who had coughed up these formations for six months. The varicose swellings are quite pronounced. Drawn from nature; full size. (Author's observation.)

fibrinous pneumonia. In general they appear as dichotomously branched, cylindrical, sometimes more flattened, at times more tubular, large and small coagula which float in water when containing air, but when freed of all frothy mucus and containing no air bubbles, they sink to the bottom. Rather numerous enlargements may frequently be seen in the smaller branches, which give the impression as if they originated in bronchiectasie (Fig. 2). According to Biermer, they are caused

by the exudate, during coagulation, meeting with obstacles, or by unequal quantities of coagulable exudate having been excreted in various situations. Their size is variable; according to the intensity of the process and the site of their formation, we meet with tree-like examples with widely-branching offshoots, which may reach a length of 12 cm., or short, non-branched and thinner ones. The former will come from the lower widely-ramifying branches of the bronchial tubes, the latter from the bronchi of the upper portions of the lungs.

The microscopical examination, which is best made with alcoholic preparations, shows us a mainly structureless material, in which principally mucus and pus-cells, but also fat-globules, are embedded. Fränkel succeeded in cultivating the streptococcus pyogenes (Rosenbach) from such a source. According to Riegel,¹⁰ a lamellated structure, a concentric arrangement, may be recognized on transverse section, especially at the thicker portions, from which he concludes that the process takes place in stages; in one case of Kretschy,¹¹ four tender, transparent lamellæ of different thickness could be separated in an alcoholic preparation. Charcot was the first to describe colorless crystals in the form of double pyramids, which appeared in them, which closely resemble the asthma crystals of Leyden, or those found by Neumann in leucæmic spleens. They have also been repeatedly found by other investigators, recently in copious masses by Escherich, together with spirals (p. 115).

The chemical characteristics of these coagula indicate their belonging to the albuminoid substances; swelling in salt solutions and dilute acids to a mucoid mass, sparingly soluble in alkalies, particularly lime-water.

CRYSTALLINE FORMATIONS.

These always indicate that chemical processes have taken place in the pathological products of secretions. The following principally appear in the sputum:

1. *Needles of Fatty Acid* (margarin crystals).—These products, first observed and described by Virchow,¹² which occur wherever putrid decomposition of animal substance takes place, are "long spear-like crystals, always very narrow, occasionally varicose, frequently sharply bent and coiled upon them-

selves, colorless, not infrequently occurring in sheaves or thick bundles. Moistened with ether and warmed, they dissolve entirely, and on cooling are precipitated in drops as a white, acid fat, of a peculiar unpleasant odor. The entire mass being treated with iodine, becomes at first greenish-yellow, in the middle of the lump somewhat bluish, later, however, thoroughly brownish-yellow."

The varicosity of the crystals may, according to Traube, be used for a hasty differentiation of the former from elastic tissue; no less important, however, is their chemical reaction, in that, as above mentioned, margarin crystals are dissolved by ether, while elastic fibres remain unaffected. They are found in the sputum during putrefactive processes within the lung, in the shape of small shreds or plugs of dirty gray color, which, when rubbed with the fingers, disseminate a foul, cheesy odor. They are by no means rare.

Much rarer are

2. *Crystals of Cholesterin and Tyrosin.*—I have several times observed them in sputum from cavities, Biermer in empyema. They also most probably result from fatty metamorphosis of pus-corpuses, and are sufficiently characterized by their appearance. They consist of large, completely transparent, thin, rhombic plates, frequently so thin that one has to select the smallest possible diaphragm for examining them microscopically with 200 to 300 diameters in order to clearly discern their contour. The addition of boiling alcohol, ether, or petroleum dissolves them.

Their rare occurrence may be attributed to the fact that cholesterin, probably held in solution, is either dissolved in the protoplasm of the cellular elements or suspended in minute particles.

Tyrosin, the occurrence of which, in a purulent pleural exudate which perforated into the lung, is described by Leyden,¹³ I believed I had once seen copiously crystallized in characteristic sheaf-like masses of needles, after long keeping and drying out, in the sputum of a young woman; the patient was the subject of advanced bacillary phthisis, with the formation of cavities (Fig. 4). The macroscopical view permitted hardly any doubt. A chemical investigation, with sulphuric acid, carbonate of barium, and a solution of chloride of iron, undertaken by myself and Dr. Hartmann, failed to give the usual

tyrosin reaction. Professor Meyer, of Marburg, who was kind enough to pursue a further chemical investigation, found that the crystals consisted of oxalate of ammonium.

The microscopical examination of the sputum in this case, in addition to numerous Koch bacilli, showed pus-cells undergoing fatty disintegration and innumerable bacteria (putrefactive organisms?). It may be surmised that the origin of such products of decomposition depended upon the existence of certain saprophytes.

Deserving of especial recognition are

3. Pointed octahedral *crystals*, first discerned by Charcot and Neumann in the spleen, in leucæmic blood and in bone marrow, later in human semen by Böttcher,¹⁴ and in the sputum



FIG. 3.

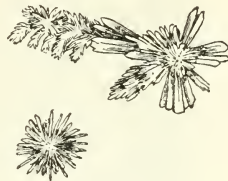


FIG. 4.

FIG. 3.—Crystals of cholesterol with pus-cells from a phthisical sputum. (Author's observation.)

FIG. 4.—Oxalate of ammonium crystals, deposited from a phthisical sputum after prolonged keeping in a test-tube. (Author's observation.)

of *asthmatics* by Leyden.¹⁵ If the glassy, often jelly-like, tough, grayish-white expectoration of asthmatics be examined, peculiar, whitish opaque balls, worm-like threads of coagula or plugs will be often noted in the colorless basis substance, the centre of which incloses more or less of a yellowish, sago-like, brittle body, which contains the crystals. These threads or strands have been very closely studied by Curschmann,¹⁶ and were called spiral threads or spirals by that observer. They are 0.5 to 1 mm. thick, and 2 to 3 mm. long; very firm and resistant to the pressure of the cover glass, and often traversed by a thin central filament. According to Pel they dissolve in potash lye and baryta water, from which he concludes that they consist largely of mucous filaments. Cursch-

mann convinced himself by sections that they are hollow, and concludes that they are very probably bronchial discharges.

The crystals are generally very small, so that it is necessary to employ a higher (600 diameters) magnifying power, and to previously rub the sputum particles thoroughly between the cover-glass and slide. If the microscopical preparations are allowed to stand twenty-four to forty-eight hours, according to Eichhorst,¹⁷ the crystals become much larger, but their number decreases. The large crystals not infrequently, per-



FIG. 5.—Asthma crystals from sputum. (After Leyden.)

haps in consequence of the pressure exerted, show defects, as if broken, which, according to A. Fränkel, points to a soft consistence (Fig. 5, right above). They are demonstrable for weeks afterward; they may also be colored by alcoholic solutions of aniline dyes (fuchsin), and may be preserved in xylol-Canada balsam.

Their chemical nature is not yet sufficiently established; they appear to be insoluble in ether, alcohol, and chloroform, but they disappear very rapidly on the addition of warm water, alkalis, and acids; they swell until they become invis-

ble when brought in contact with glycerin. Oertel believes that micrococci lead to the disintegration of round cells, and that the crystals separate from the granular detritus. From the

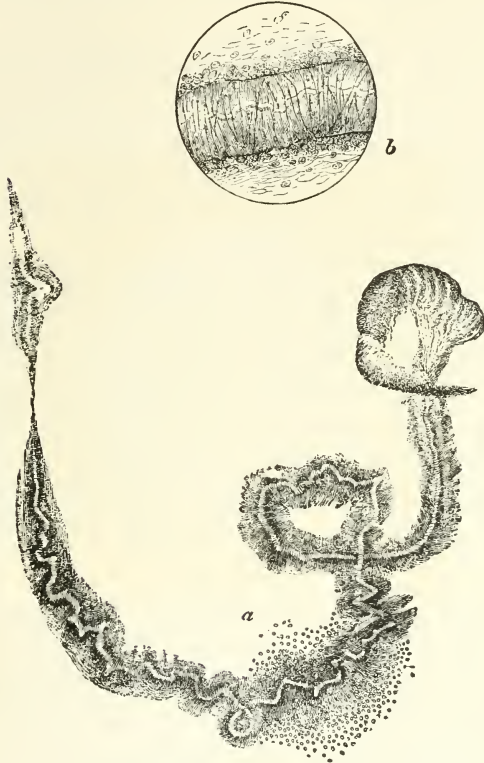


FIG. 6.—Spiral fibres; *a*, magnified 80 diameters; *b*, a portion of *a* magnified 300 diameters. (After Leyden.)

investigations of Schreiner and Fürbinger it appears probable that they incite a decomposition of albuminoid bodies, and probably are related to ptomaines.

It should also be mentioned that no special pathological

significance for bronchial asthma can be attributed to these crystals, since we find them in the sputum of bronchial catarrh (bronchiolitis) and in the coagula of fibrinous bronchitis and in bacillary phthisis (Kaatzer), pleuritic exudations, and in the nasal mucus.

Whether we look upon them, as Leyden does, as an etiological factor in asthma owing to the mechanical irritation they exert on the sensory nerves of the bronchial mucous membrane; whether we regard them, with Curschmann, as the product of time, dependent upon the protracted stagnation of the sputa in the bronchioles and an accompanying regressive metamorphosis of the cellular elements—at any rate, we will have to adhere to the fact that they are among the almost constant concomitants of asthma.

Among the rarer substances found in the sputum are yet to be mentioned: crystals of hæmatoidin (small rhombic columns, of dark brownish-red color), oxalate of lime, and ammonio-magnesian phosphates (coffin and envelope shaped). All three formations have been frequently found in phthisical sputa. In the interesting cases of hæmatoidin sputa reported by Schulze, Friedreich, and Renz, tuft-like and needle forms predominated as compared with rhombs; these forms particularly have been described with great accuracy by Virchow. Ungar demonstrated oxalate of lime in characteristic octahedral form in the sputa of asthmatics, together with asthma crystals, during the time of the paroxysms.

ENTOZOA.

Of these, so far as is now known, only the *ecchinococcus hominis* appears in the expectoration. According to a compilation by Frey,¹⁸ it was found in the lungs in 12%. If the *ecchinococcus* cyst ruptures and empties its contents into a bronchus or a cavity produced secondarily, a large quantity (as much as two quarts) of a clear, saline fluid of peculiar taste is expectorated, in which *ecchinococci* in the form of small, whitish-gray, gravel-like granules, as also daughter cells, or finally white membranes curled up on the borders may be macroscopically noticed; microscopically hydatid debris, hooklets, and scolices are discovered. The membranes show a lamellated texture, layers of regular parallel strips, which Jul. Vogel has compared to the oblique cross section of a book.

REMNANTS OF FOOD.

During the transit of the expectoration through the mouth, the most diverse remnants of ingested food, etc., which have remained behind in the dental interstices, become mixed with it. Among these, the first to be mentioned are the residue of vegetables, potatoes (starch granules), bread crumbs, particles of caseous milk, snuff, etc.; of the animal articles of diet, are principally meat fibres, elastic fibres, free fats after indulgence in milk and emulsions, which surprise the observer of limited experience and may bring him to despair. Both forms have frequently led to error. It is therefore necessary that the observer should be familiar with the microscopical appearance especially of vegetable tissue and the granules of starch-flour, as they occur principally in potatoes and seeds. Vegetable cells are angular bodies placed side by side, which form rhombo-dodecahedra, and appear as six-cornered meshes on section; granules of starch are transparent, colorless bodies, presenting an appearance of concentric layers; they give the well-known iodine reaction.

All these admixtures will most frequently be found when the sputum comes from badly cleaned mouths, and on the bottom of the receptacle. The greatest possible cleanliness of mouth and teeth of patients should therefore be aimed at; the investigation is rendered easier thereby and time is saved.

MICRO-ORGANISMS.

Fungoid formations in the expectoration are long well known. This applies to the leptothrix form, the thrush fungus, and some foul-smelling, smeary particles resembling the eggs of spiders, discussed more fully in another place, which are principally composed of micro-organisms. The presence of the latter has, for instance, given rise to the expression, "spider-cough," when speaking of the respiratory disturbance associated with them. Until recent times they were regarded as non-essential constituents, which accidentally became mixed with the expectoration from the coating of the tongue or the tonsillar crypts. The perfection of microscopical technique and the advanced state of artificial bacterial culture brought about by R. Koch made it possible for us to more correctly

interpret the importance of the discovered fungi to diseased processes, and to positively demonstrate their morphological and biological significance in the causation of certain affections.

First in importance are the bacilli of Koch, the presence of which in the sputum unqualifiedly proves that in such cases bacillary infection must exist. They belong to the class of schizomycetes (fissure fungi, from *σχιζεν*, to split), that is, that botanical species which perpetuate their species by division. They are true parasites, which can only thrive and multiply upon their host; they require a temperature of 86° F.; their existence is therefore bound to animal and human organisms, in which they go through the states of their development, in contradistinction to other bacteria, as, for instance, the bacilli of anthrax.

In length they are, according to Koch, about one-quarter to one-half the dimensions of red blood-corpuscles, about 0.0015 to 0.0035 mm.; extremities cannot be demonstrated. When stained, they appear thinner than when colorless. This is because before staining they must be viewed through refracted light, by which the lines of interference which appear at the borders apparently enlarge the diameters, while the investigation of the stained bacilli takes place under full light obtained from all sides, which excludes all phenomena of interference.

The little rods are in general not perfectly straight, but show slight kinks or bends. Their principal point of distinction from other, in form and size very similar micro-organisms consists in their great affinity for certain aniline colors, which the bacilli of Koch retain with great tenacity, so that they do not readily yield up their stain, even in the presence of strong acids, and retain it moreover astonishingly well when doubly-colored.

The originally so-called Koch-Ehrlich staining method, which, besides demonstrating the presence of these bacilli also proves their specific character, has been variously modified, but these changes do not embrace any differences in principle. Skill, light, instruments, staining fluids, etc., must above all be adequate.

The procedure as I now employ it, and which I have tested as the most feasible for practitioners, after an experience with it embracing thousands of sputum investigations, is as follows:¹⁹

I spread the first sputum voided in the morning, which I

caused the patient to expectorate into a wide test-tube fitted with a cork of absorbent cotton, upon a blackened plate or a piece of black paper, and remove by means of platinum needles, previously sterilized in a flame, the smallest particle from the darkest or seemingly most prolific spot. I place this between two cover-glasses (0.12 mm.), distribute it upon their surfaces, best by drawing them apart (not lifting them), or by gently rubbing them until dry, and put them aside to dry. I then proceed to prepare the necessary solutions.

After filling the bottom of a test-tube with aniline oil to the depth of about 2 cm., it is shaken for a minute with about $\frac{3}{4}$ of a test-tube of sterilized water and allowed to stand. This constitutes saturated aniline-water. [Distilled water should be cooked for a long time when it is to be used in bacteriological investigations, or should be sterilized in a sterilizing apparatus, because it always contains bacteria and germs.]

I prepare my staining fluid preferably of gentian violet, because it gives the clearest pictures; the gentian violet is added in excess to 95% (acid free) alcohol; generally about 20 to 25 gm. of coloring matter are required for 100 gm. of alcohol. This solution may be kept for months, while the aniline-water must be freshly prepared for each use. The aniline solution is then filtered through previously moistened filter-paper into a watch-glass, and from 12 to 15 drops of the staining fluid added to it by a drop counter or pipette and then stirred with a glass rod.

By this time the cover glasses containing the sputum are air-dry, and, after being slowly passed three times through an alcohol flame, sputum side up, are laid upon the aniline staining solution. They are either allowed to float here for twenty-four hours (longer does no harm), or I proceed, according to the time at disposal, with the completion of the examination. For this purpose I place the watch-glass containing the preparation upon a tripod with a wire net, under which a spirit flame of moderate intensity is placed, raise the fluid to the boiling point, and allow it to cool. I then begin the decolorizing. The solution which I prefer for this purpose consists of a mixture of 100 gm. of 90% alcohol, 20 gm. of distilled water, and 2 gm. of concentrated murlatic acid. I fill a deep capsule (No. 1) with this solution, a second one with 90% alcohol (No. 2), and a third with distilled water (No. 3.) After removing the cover-

glass with the forceps, I rinse it from one-half to one minute in No. 1, then just as long, or until the residue of the blue color has disappeared, in No. 2, and then in No. 3, constantly agitating while immersed in the different fluids.

If the double staining for differential diagnosis is to be at once utilized, which with greater experience may be dispensed with, the cover-glass, after becoming dry, may be immersed one-half to one minute in a filtered concentrated solution of vesuvin, mixed with water, and placed under the microscope with a drop of water. In such cases the bacilli of Koch will be doubly stained with violet and black, the remaining portions

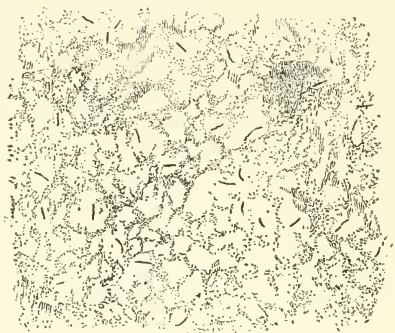


FIG. 7.—Dried sputum, prepared fifteen months previously, containing Koch's bacilli, which present partly a granular appearance. (Author's observation.)

of the preparation brown. The black color is due to the fact that the aniline brown absorbs the blue portion of the spectrum, and therefore a blue object viewed through a brown solution must appear black.

As regards the microscopical examination, I cannot concede the propriety of a test which is regarded as sufficient when made under a power of 300 to 400 diameters. Even though it may be possible for one familiar with bacilli to attain his object under such conditions, in general, and where small quantities of Koch bacilli are to be examined, apart from the great saving in time, it is a *sine qua non* for securing accurate data that an immersion lens and an Abbé condenser be used. As already mentioned, the bacilli when double stained appear as

dark violet to black little rods, which occasionally seem to be slightly bent or sharply cut off. Under very powerful enlargement (1,000 to 1,200), one is often able to note spore formation upon them. One then sees in the rodlets at regular intervals two to four egg-shaped uncolored portions, bordered on their edges by a finely-colored line.

Those rodlets which present a bead-like granular appearance (a phenomenon which is pretty frequently observed in stained Koch bacilli, and which was noted by me in the "*Deutsche Med. Wochenschrift*," No. 17, 1885), were formerly considered as bacilli containing spores. The spores, however, never become stained, but are marked, as above mentioned, in the colored rodlets as colorless round areas. The "granulation," according to my view, occurs most frequently in progressive ulcerative processes in the lungs, and is perhaps the expression of a granular disintegration of the bacilli, a special form of regressive metamorphosis. I have not been able to confirm a special influence of fresh concentrated nitric acid upon the development of this modification, as suggested by Voltolini.²⁰



FIG. 8.—Portion of fresh phthisical sputum. Koch's bacilli with spores; the latter are unstained. Adjoining them are round cells; to the right above, a pavement epithelial cell with nucleus and nucleoli. The black portion on the left consists of inhaled dust (free pigment). $\times 1500$. (Author's observation.)

If examined without double staining, the bacilli lie as unmistakable, sharply-defined, violet-black rodlets upon a faintly-tinged violet ground. An absolute decolorization cannot be brought about by the acid alcoholic solution; the preparation always retains a violet tinge, and in some fields of view shows, besides the bacilli, other deeply-stained violet bodies, for instance impurities, epidermal scales, etc. According to Celli and Garnieri, fine fat needles also occasionally appear, which react to staining agents almost exactly like the bacilli of Koch—"pseudo-bacilli." They may be readily distinguished, however, by their size and their reaction to ether and chloroform.

An almost perfect decolorization of the violet with substitution of a yellow tinge and at the same time an almost black

staining of the bacilli, may, in my experience, be attained by allowing the cover-glass to float ten to fifteen minutes in the compound iodine solution, after washing it in the acid solution and alcohol (Nos. 1 and 2), after which the superfluous fluid is to be removed with filter-paper and the preparation at once examined in pure glycerin.

If the preparations (gentian-vesuvin double stain) are to be preserved, they are to be mounted in Canada balsam, and, after they have dried, surrounded with a ring of lacquer. They may be kept for a considerable time. This keeping quality may perhaps be explained by my employing alcohol with muriatic acid instead of nitric acid (Ehrlich), and therefore support the statement of Brun,²¹ according to which the nitric acid remaining in the preparation is the cause of the bacilli finally losing their coloring. Orth²² declares that the bacilli become decolorized in Canada balsam because of the chloroform contained therein, and even attempts to explain in this way the non-success of Spina. I must contradict this opinion, because I can still demonstrate well-stained bacilli in preparations which I have kept for three years.

As regards the question, for how long the bacilli may be demonstrated in sputum containing them, I can say that I have been able to stain them in the dried sputa of phthisis almost four years old.

Occasionally I saw large cocci-like spots in sputum-preparations which had yielded up the violet staining; these bodies may be spores of other bacilli, resembling or like those observed and described by Gaffky⁴ in intestinal phthisis.

The so-called pneumonococci, which have, according to the experiments of C. Friedländer,²³ a specific pathogenic action in the etiology of pneumonia, are another form of bacteria found in the sputum. Those cocci (single, diplo- and triplococci) are surrounded by a characteristic coating of a jelly-like substance with sharp external contour, which is more feebly stained in coloring dry preparations than the coccus itself. Their detection may be the most readily accomplished by the procedure recommended by C. Friedländer²³ in 1885; the preparations are to be drawn through a flame three times, and then immersed for several minutes in 1% acetic acid; after the latter has been removed by blowing through a glass tube with a pointed end, they are rapidly dried in the air, immersed for a few seconds

in a saturated solution of aniline-water and gentian violet, rinsed off with water, and examined with an immersion lens. It is then seen that the basis substance has remained completely or almost completely colorless, whereby the stained portions, among others the capsule, when it exists, appear more distinct. If the staining action has lasted too long, so that both are too intensely colored, decolorization may be carefully effected by means of dilute acetic acid or alcohol. Ac-



FIG. 9.—Portion of the rusty sputum of fibrinous pneumonia (4th day), from a man *æt.* 38. Pneumonococci with distinct capsule; some in which it is not marked are in groups of one, two, and four. *a*, pavement epithelial cell inclosing numerous oral (?) cocci; *b*, rod-shaped bacteria; *c*, common bacillus from the oral cavity. (Author's observation.)

cording to the method of Ribbert,²⁴ with which I have no experience, the procedure is as follows: the preparation is brought in contact with a staining fluid resembling that used by Ehrlich²⁵ for coloring mast cells (100 gm. distilled water, 50 gm. alcohol, 12½ gm. acetic acid), saturated with dahlia while hot, then at once rinsed in water and examined with immersion lens and condenser. The cocci have a deep blue color, while the capsules are light blue.

If decolorization of the capsule occur during the technical

manipulations of the preparation, we have intensely colored cocci with colorless capsules before us. In such cases it will be difficult to decide by microscopic examination whether we are viewing Friedländer's pneumonococci or other encapsulated forms of schizomycetes, such as have long been recognized as round or elliptical cocci, and diplococci of the size of pneumonococci, and as I have encountered them, although isolated, in phthisical sputum. [While these sheets were passing through the press, I examined the sputum of a gentleman, æt. 75, affected with chronic bronchitis and bronchiectasia. The muco-purulent sputum at times (first morning expectoration) consisted of innumerable cocci, mostly in pairs, with a bright areola, and a few pavement epithelial cells inclosing large quantities of cocci and bacilli in swarms. Koch's bacilli were absent.]

Accordingly, only cocci with stained capsules can be accorded diagnostic value; the presence of elliptical cocci surrounded by light halos alone will not suffice. It should here be mentioned that Pasteur had already in 1881 experimented with such cocci with hyaline halos—*petit halo transparent*. As he found them in the sputum of a child suffering from hydrophobia, he erroneously claimed them to be pathogenic micro-organisms producing the virus of that affection.

The bodies first found in the sputum by R. Koch, and cultivated by Gaffky⁴ and declared to be pathogenic micrococci, also belong here; they are generally surrounded by a rather distinct halo, and by their peculiar arrangement and almost regular grouping in fours, possess a certain similarity to *sarcinæ* (*micrococcus tetragenes*). In addition A. Fränkel²⁶ has shown that, besides the pneumonococci of Friedländer, other pathogenic micro-organisms exist in the sputum, of which one closely resembles the former coccus in morphological characteristics and possesses the same capsular formation. Because of its experimentally established blood poisoning and deadly influence he called it the coccus of sputum-septicæmia. [If inoculations be made with such sputum, after being rubbed up with four or five times its quantity of water and filtered through linen or gauze, before injection into a number of rabbits, some of them regularly die within twenty-four to forty-eight hours. In the blood of these animals, this septicæmia coccus is exclusively found, often in immense numbers. Those

inoculated with the blood of the dead animals show the same parasitical affection.] Another form may be biologically distinguished from Friedländer's cocci, in that it requires a higher temperature for cultivation, that it possesses a short-lived vitality of but a few days, and that it is easy to deprive it of pathogenic properties by the influence of temperature (107.6° F.).

Of other micro-organisms in the sputum, which are either not pathogenic or the infectious nature of which is doubtful, the various forms of schizomycetes remain to be mentioned, which vegetate in the oral cavity and its adnexa, in the coating of the tongue, the tonsillar crypts, dental deposits, etc., as well as the putrefactive organisms which develop in stagnating sputum. These are found in almost every preparation, and

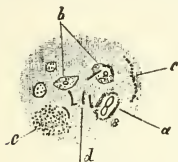


FIG. 10.

FIG. 10.—Pneumonic sputum kept two days. *a*, pneumonococcus with bright halo; *b*, epithelial cells with nucleus and granular contents, one containing a Koch bacillus; *c*, chain of cocci; *d*, Koch bacilli; *e*, zoöglæa swarm. (Author's observation.)



FIG. 11.

FIG. 11.—Portion of fresh phthisical sputum. *a*, alveolar epithelial cell; *b*, Koch's bacilli; *c*, coccus tetragenæ, resembling sarcina; *d*, oval cocci. (Author's observation.)

some of them have given rise to the most daring conclusions. I call attention only to the comma bacilli found in the mucus of the mouth by Lewis,²⁷ declared by him to be identical with the cholera bacilli of Koch, which are frequently present in great quantities in hyperæmia of the gums, caries, etc. A fungus defined by Miller²⁸ as ϵ -shaped, often forming the letter S by lying in apposition, is according to Flügge²⁹ probably identical with the Finkler-Prior spirillum. In addition, Miller has in recent years isolated 25 diverse forms in the mucus of the mouth, 12 cocci and 13 bacilli, the characteristics of each of which have not yet been completely reported.

For differentiating these numerous forms of bacteria, morphologically so similar, and for determining their essential biological and infectious properties, only examinations in pure cultures and experiments upon animals can serve as a guide.

Regarding certain putrefactive micro-organisms, Rosenbach³⁰ succeeded in finding one and the same microbe in the mucous plugs in recesses of the mucous membrane of the lateral pharyngeal wall while in a catarrhal state, the almost insufferably fetid odor of which prompted him to undertake an investigation. He calls it the bacillus saprogenes No. 1. He considers this bacillus a decidedly putrefactive microbe, possibly the most widely diffused, which in itself produces the odor of decomposition, even in those cases where it cannot penetrate its host and decompose it.

If sputum from a cavity be allowed to stand for some time, it becomes, as I have now and then observed, light green in its upper layer and resembles in odor trimethylamine. Similar observations were made by Curschmann and Escherich in the sputa of asthma and fibrinous bronchitis. Doubtless the green color and the odor are the product of saprophytic bacteria which produce coloring matters and in addition cause a more complete decomposition of albuminoid substances. We have the best-known analogue in the fungus of greenish-blue pus (bacillus pyocyaneus). A fungus was cultivated at the Göttingen Hygienic Institute from a putrefying substratum, which caused the green color and the odor mentioned (bacillus fluorescens patidus, Flügge²⁹).

As better-known fungi which occur in the sputum I have to mention the species of leptothrix, the most frequent forms of which have been called leptothrix buccalis, and oïdium albicans. The former, according to Flügge²⁹ consists only of a developmental form, a filamentous condition of certain bacilli, in the formation of which others, for instance, the bacillus butyricus or some anaerobic bacteria, not rarely participate. The common property of both, under certain circumstances, of forming a blue, darkening to violet-black colored combination with iodine (granulose) in the plasma would seem to substantiate this. According to Leber, this coloration ensues upon the simultaneous addition of very dilute muriatic acid, acetic acid, or lactic acid to iodine. If acid reaction already exists in the medium, the addition of iodine alone will suffice. Under the microscope leptothrix are seen as very long, thin and apparently non-segmented filaments, often united in close bundles or felted masses, either alone or in company with spirochæte from the gum-mucus, most often embedded in thick

masses of micrococci. Pure cultures of the *leptothrix buccalis* have so far not been effected.

The thrush fungus, *saccharomyces albicans* (formerly described as the *oïdium albicans*) is, according to Grawitz³¹ identical with *S. mycoderma*. It occurs most frequently as "thrush" in the saliva of children who are fed with milk; also in adults very much reduced in nutrition, and in phthisical subjects. It consists of partly globular, partly oval or cylin-

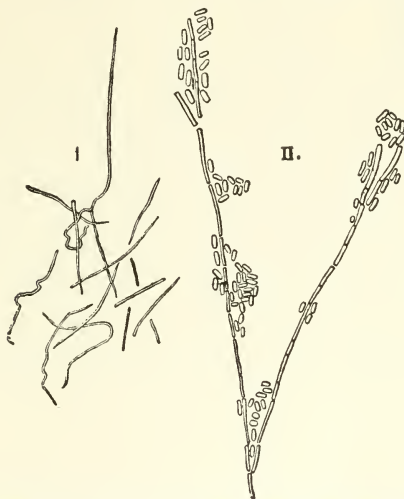


FIG. 12.—I. *Leptothrix buccalis*. II. *Saccharomyces albicans* (thrush fungus) with sprouting colonies. (Author's observation.)

drical cells, which proliferate, according to the abundance of saccharine matters, into long filaments; between these are copious oval spores, which form between the epithelial cells of the uppermost layers and upon the surface itself, a mycelium of varying thickness.

Both of these, the *leptothrix* and the *S. mycoderma*, have been found in large quantities in the sputum of putrid bronchitis, so that it appears probable that, having gained entrance to the lungs by respiration, they had there multiplied in a stagnant secretion (cavities).

Of other fungi, which interest more from their incidental occurrence in the sputum, a few varieties of the aspergillus must be mentioned. Guided by experiments upon animals,⁴ according to which birds (doves, geese, and smaller birds) which were exposed for several minutes to an air filled with spores of aspergillus fumigatus, died of pneumonia within five days, one does not go astray in attributing their influence to the causation of pneumonic focal diseases.



FIG. 13.—Eurotium
Aspergillus glaucus, \times
300. (After Lieber-
mann.)

Herterich found in the gray hard sputum particles of a patient with redness and excoriations in the trachea mycelium formations of eurotium aspergillus. Rother also reported a case from Leyden's clinic, in which a patient with symptoms of infiltration of the pulmonary apices, occasionally expectorated grayish-green crumbs of an asbestos-like lustre, which upon microscopical examination proved to be necrotic shreds of pulmonary tissue, copiously traversed by the stems and heads of the aspergillus. The case recovered. In general, however, it is reasonable to believe that a number of the schizomycetes and mycelium forms, often found abundantly in the sputum, are simple saprophytes, and have no etiological significance.

CHAPTER IV.

CHEMISTRY OF THE SPUTUM.

I. ORGANIC CONSTITUENTS.

Water.—Water forms the main constituent of the sputum, and exists, according to Biermer, in the proportion of 882 to 979 per thousand; it depends chiefly upon the character of the diseased process, the composition of the secretion caused by it, and upon the quantity of saliva which becomes associated with the expectoration in the mouth. The sputum is most rich in water in pulmonary œdema (serous sputum); then come the sputa in the first stages of a catarrh, in emphysema, and the bronchial affections associated with convulsive paroxysms of cough.

Albumin and Sugar.—Next to water, albuminoid bodies predominate in the formation of the sputum, in that they are more or less abundantly present dissolved in water, according to the inflammatory grade of the affection of the mucous membrane.

The sputum in the last stages of phthisis contains the greatest quantities of albumin; bronchitis, the least. According to the investigations of Bokay,³² serum-albumin and globulin are generally sparsely present; an albuminous material resembling myosin is, on the other hand, generally abundant. It appears from the analyses of Bokay, that the quantity of albumin depends upon the number of formed elements. As regards myosin we know that very probably it is formed by the death of the protoplasm, in like manner as we may observe it on the cessation of muscular contractility in cadaveric rigidity. Albumin may be detected in the sputum by acidifying it strongly with acetic acid, adding about a like volume of concentrated saline solutions (table salt, sulphate of soda or magnesia), and then heating to boiling. A white flocculent precipitate forms if albumin be present.

It might occasionally prove of diagnostic value to test the sputum for sugar, which is known to be present in diabetes and *ecchinococcus*. The above albumin test may be utilized for this purpose; the albumin coagulum is merely filtered off, and the filtrate treated with Fehling's solution in the usual way.

Mucin.—Mucin, a derivative of the albuminoids, is a product of the secretory cells of the mucous glands (mucous cells). It gives the sputum its tenacious, glassy, often jelly-like, colorless character, and is mingled with the sputum in considerable quantities from the mucous glands of the mouth; microscopically it appears amorphous. Its detection in the sputum may be accomplished by alcohol, extraction of the coagulum with hot water, and filtration; the filtrate is to be mixed with several drops of acetic acid; this causes a turbidity or precipitate insoluble in the excess; by this and by the sparsity of the precipitate on the addition of ferrocyanide of potassium mucin may be distinguished from the other albuminous substances resembling it (Biermer).

Fats.—The appearance of fats in the form of crystals and granules and their microscopical detection has already been mentioned. The microscopical demonstration allows us to approximately estimate the quantitative relationship.

Pathology gives us the conditions for the amount of the fatty contents. The larger the quantity of pus in the sputum, the more advanced the regressive metamorphosis of the cells, the sparser will the quantity of nutritive fluid intended for the cells become, and the more intense, of course, will be the fatty degeneration of the pulmonary tissue. The fatty contents of the sputum are thus the standard of the lack of nutriment of the pulmonary parenchyma. The appearance of free fatty acids in the sputum leads us to infer that they are formed either in the cheesy foci of the diseased lungs or in the air-passages, and that their quantity is determined by the existence, disintegration, and dissemination of caseous infiltration, and further by the consistence and adhesiveness of the sputum, which, again, induces the stagnation of the latter, and, finally, by the fact that the atmosphere in which the patients breathe is relatively more or less infected with micro-organisms.

Concerning their chemical detection, reference must be made to the physiological and pathological chemical analyses of Hoppe-Seyler.³³

II. INORGANIC CONSTITUENTS.*

These appear in the sputum either in combination with morphological formations, or in free solution, or solid masses, concretions (pulmonary calculi). From the comparative investigations of Bamberger³⁴ and Kussmaul³⁵ regarding the ash constituents of the sputum, it appears that chlorine, sulphuric acid, phosphoric acid, potassium, sodium, lime, magnesia, salts of ferrous oxide and silicon compounds are present in it, and that a few substances such as phosphoric acid and potassium, show a variable behavior. The maximum of phosphoric acid in the ash of sputum was 14%; in catarrhal and purulent sputum from 10% to 13% was found; on the other hand, the ash of lungs showed a constant, very large proportion of phosphoric acid, 36% to 48%. While the potassium in lung ash played a very subordinate rôle, in catarrhal purulent sputa 16% to 24% was found.

With regard to concretions, which to the great astonishment of the patient are from time to time voided with the sputum, they may be of various origin. They are formed in the lungs, when a further metamorphosis, particularly a softening, is retarded in the smaller cheesy foci by the copious deposition of phosphate and carbonate of lime. If a purulent inflammation develops in the neighborhood of this foreign body, which acts as an irritant, and if this finds an avenue to a sufficiently large bronchial tube, it becomes expectorated with the sputum. Under similar circumstances, concretions form in the mouth upon the teeth (tartar) and the tonsils, the products of which appear as admixtures in the sputum. It is of especial interest, that according to the investigations of Klebs,³⁶ the tonsillar concretions are apparently to be attributed to the action of bacteria; they appeared as several mixtures of inorganic and organic constituents; upon dissolving the lime salts, compact heaps of bacteria remained as the organic basis. Neuwerk succeeded in detecting the bacilli of Koch in pulmonary concretions.

CHAPTER V.

THE CLASSIFICATION OF THE SPUTUM.

I. THE MUCOUS SPUTUM.

THIS is feebly transparent, of a glassy, colorless, or faintly whitish-gray appearance, can be drawn into strands and is so adherent to the vessel that the latter may be inverted without losing its contents (sputum crudum of the ancients). It loses its purely mucous character by the copious admixture of fluids and air bubbles; this may occur when the salivary secretion is mechanically increased by violent coughing fits and is mingled with the sputum, or when, as in pulmonary œdema, the alveoli and bronchi participate in the expectoration by a sero-mucous exudate.

The main constituent is mucin, the secretory product of the mucous glands of the mouth and bronchial tubes.

Microscopically we find very few formed elements in the mucus. On the addition of acetic acid, a whey-like veiled cloudiness becomes apparent, induced by coagulation of the mucin (mucin reaction). The mucous bodies sparsely embedded in the mucus are somewhat larger than pus-corpuscles, with one or two round nuclei, granular contents, and sharply defined surrounding membrane; excess of acetic acid renders them transparent and the nuclei particularly prominent. The granular contents never become stained by basic aniline dyes because of the mucin, while the nuclei take up the coloring matter with avidity.

In addition, mucous watery sputum contains as accidental and non-essential constituents, epithelioid cells, among which pavement epithelium from the oral cavity and sometimes the vocal cords is frequent, and rarely isolated ciliated epithelial cells from the bronchial mucous membrane, with and without ciliæ.

II. THE MUCO-PURULENT AND PURULENT-MUCOID SPUTUM.

By a more or less copious admixture of mucus and pus-corpuscles as observed in long-standing bronchial catarrh, the sputum loses its watery color, it becomes thickish, of a whey-like white to whitish gray and yellowish cloudiness (sputum coctum of the ancients), non-transparent in areas, so much so that opaque puriform points or streaks of varying size may be distinguished next the clear spots containing mucin (homogeneous sputum). If the proportion of pus-corpuscles preponderates (purulent-mucoid sputum), the sputum appears as a yellow or yellowish-green opaque mass which has no tendency to adhere to the vessel, sinks to the bottom in separate portions, taking on globular, so-called nummular forms, and in this manner may constitute the greater part of the total expectorated mass (heterogeneous sputum). This form gives a diagnostic characteristic of bronchiectasis and cavities. In the first-mentioned affection, great masses of such sputum (several quarts daily) are expectorated, which peculiarly recall the odor of acid perspiration. The expectoration takes place in gushes, very often on changes of position, and fills the entire mouth (mouthful expectoration of Wintrich). The latter is never the case in phthisical cavities.

After the purulent-mucoid sputum has stood for some time, it has a tendency to confluence, and then generally forms three layers, which are explained by the difference in specific gravity. The upper layer is muco-purulent, frothy and filled with air bubbles, after longer standing of yellowish-green or dirty-green color (bacterial action, p. 126); the middle layer is richer in water, mixed with dirty-white mucous flakes containing albumin, which float about freely; the lowest heaviest layer is thicker, purulent, and forms a homogeneous sediment, which consists chiefly of partly swollen, partly fatty or granular disintegrated round cells and the most diverse bacteria.

If black, brown-streaked, dung-colored decomposed masses are mingled with the sputum, which appear microscopically as a conglomeration of elastic fibres (signs of ulcerative processes in the wall of the ectasis), crystals of fat, fat-globules and putrefactive bacteria, then it is in general not lacking in a pronounced odor, which points to a protracted sojourn in the bronchial cavities, or mycotic decomposition and destruction

of the tissue and vessels. Schultze³⁷ in a rare case found therein copious quantities of hæmatoidin crystals in the form of single needles, bundles of needles, and rhombic plates (p. 115). As evidence that these putrefactive processes have taken place in the lungs, freshly-voided sputum is requisite, as well as experiments with other sputa, which after several weeks' standing yield the same products.

Chemical examination of these masses gives putrefactive products of albuminoid substances (sulphuretted hydrogen, ammonia, leucin, and tyrosin), partly products of the decomposition of neutral fats, copious fatty acids, and traces of glycerin. Escherich¹⁷ has several times demonstrated a peptonizing ferment resembling trypsin.

III. THE PURELY PURULENT SPUTUM.

Purely purulent sputum only comes to our view when the contents of a pulmonary abscess or an empyema cavity have been evacuated. It does not differ from ordinary abscess pus, and like this separates into two layers, one of which contains the pus-serum, the other the cellular constituents. Microscopically it consists of round cells, partly in a state of fatty degeneration, pus cocci, and bacteria.

IV. THE BLOODY SPUTUM.

Bloody sputum shows all shades of color, from a light yellow to dark black, according to the quantity of blood-discs mingled with the expectoration. The form and grade of the blood admixture leads us to speak of sputum streaked with blood, sputum spotted with blood, sputum intimately mixed with blood, and pure bloody sputum.

The two first-mentioned characters obtain in acute and milder forms of chronic catarrhal inflammation of the bronchial mucous membrane and the pulmonary parenchyma; they appear not rarely as accidental admixtures from the gums, or in general disturbances of nutrition and infectious diseases.

The so-called vicarious bronchial hemorrhages and the sputum of fibrinous pneumonia also belong in this class.

The more profuse hemorrhages characterize attacks of hæmoptysis in phthisis, gangrene of the lungs, abscess of the

lungs, and the so-called hæmoptysis nervosa, as occasionally observed in the mentally deranged and in nervous disturbances of the cerebrum and spinal cord; in ecchinococci of the lungs also, the expectoration of their fragments is not infrequently preceded by hæmoptysis. An especial form of hæmoptysis of parasitic nature appears to occur among the Japanese, in the sputum of which Bälz¹⁷ found psorosperms. He calls the disease itself Gregarinosis pulmonalis.

The quantity of the bloody sputum may vary greatly. It will not be easy to draw differential diagnostic inferences therefrom for pulmonary or gastric hemorrhage in case the history of the case is of doubtful character. The quantity of the blood coming from the lungs is generally less than when coming from the stomach. The composition of the blood-coagulum may also be of importance; the latter becomes more perfect and aërated in pulmonary hemorrhage, where the blood comes in contact with the acid stomach contents, so that on section, small hollow air-containing cavities are encountered, which may give it a porous, sponge-like appearance and greater lightness. For the same reason, the blood in hæmoptysis will have an alkaline reaction, while in hæmatemesis, especially if it be not too profuse, it will show a neutral or acid reaction.

Of less practical importance is the question whether the quantity of the blood voided may point to a capillary or an arterial source. To definitely determine the origin of a hemorrhage from the respiratory tract will not always be possible.

In the most fortunate case, the microscopical examination of the sputum will give data regarding the nature of the process (*e.g.*, the Koch bacilli), but not the locality of the hemorrhage. Its most frequent site is in the pulmonary parenchyma and the bronchi. It has frequently been my experience at health resorts to have patients bring me their bloody sputum in great trepidation, while their history, as well as the physical examination of the lungs and the microscopical scrutiny of the expectoration, gave negative results. Later continued observation of the patients in question confirmed my conclusion, that in these cases we had to do with a mechanical admixture of blood from the mucous membrane of the mouth, the nose, and the pharynx by the probably violent efforts at expectoration, or, else, that loose, readily-bleeding gums un-

consciously sucked during the night, were the source of the sanguineous admixture. Such frightened patients are often hard to convince of the innocent nature of their bloody sputum. In general, however, the smallest bloody admixture requires careful, continued observation. It occurs not very rarely, that sputa for days at a time colored with blood are but the precursors of a severe hæmoptysis. The therapeutic measures (physical and mental rest, ice-bags) acquire increased importance for this reason.

The assertion has been made by French authors that it is possible to recognize a hemorrhagic infarction by the peculiar acid, garlicky odor of bloody sputa, calling to mind the smell of tincture of radishes; so far as I know, this diagnostic critical refinement has not yet found confirmation in Germany.

CHAPTER VI.

THE SPUTUM IN SPECIAL DISEASES OF THE RESPIRATORY APPARATUS.

I. THE SPUTUM IN BACILLARY PHTHISIS.

It has always been the endeavor of practitioners to utilize the expectoration as a diagnostic criterion in the clinical history of phthisis.

It was believed that the granular, half-soft, crumbling masses in the sputum were to be regarded as tubercular material; but Laennec³⁸ had already called attention to the fact that these originated in the mucous follicles of the tonsils, and differ from tubercular material in that, when rubbed between the fingers, they give off a fetid odor, and when warmed upon paper leave fatty stains.

To Virchow is due the credit of having demonstrated that the tubercular material is nothing else but caseous masses, the product of regressive metamorphosis, which may attack the various tissues in different parts of the organism. That the so-called tuberculous material contained a specific virus was not yet known.

The reports of autopsies by Buhl, in 1857, first pointed out that phthisis was brought about by the absorption of a virus existing in the primary cheesy foci, and Niemeyer succeeded in utilizing this view, if in somewhat modified form, for clinical purposes. Experiments did much toward clearing up this question. After Villemin, Klebs, Cohnheim, and Damsch had succeeded in producing the so-called inoculation-tuberculosis by inoculations of tubercular masses upon animals, and, in 1877, Tappeiner and Schweninger had caused tuberculosis of the lungs by the inhalation of finely powdered phthisical sputum, the study of the infectious nature of tuberculosis was placed upon a firm basis; there could hardly be any doubt

that the tubercular substances contained an organized uniform infectious matter. The nature of this matter was surmised by Klebs in 1877; and he gave the weight of his authority to the micro-parasitic character of tuberculosis. Although the existence of such a micro-parasitic virus would readily explain the nature of tuberculosis, it remained for R. Koch to furnish incontrovertible evidence thereof by the discovery of the Koch bacilli. The experiments of Koch, essentially pursued in the field of pathological anatomy, I may premise, have been confirmed by all investigators who have tested the question of tuberculosis *sine ira et studio* in this direction. The experiences and observations which clinical research derived from the new dogma, have called forth a copious literature, which principally discusses the diagnostic significance of the Koch bacilli in the etiology of phthisis, and thereby testify to the overwhelming practical importance of the detection of these infection-producers. The results of the more important works almost unanimously agree that the detection of these bacilli in the sputum not only establishes an infallible sign of the existence of a bacillary affection of the respiratory organs, but is also capable of making a certain diagnosis possible in initial processes before the physical signs are of any value, and to remove all doubts in uncertain cases of differential diagnosis. The few works, which, probably by reason of insufficient technique in investigation, arrive at different contrary conclusions, cannot be regarded as objectively critical productions. Even Brehmer,³⁹ who felt compelled to dispute the exclusively bacillary nature of phthisis in the light of his clinical observations, in his latest paper, "Die Therapie der chronischen Lungenschwindsucht," expresses himself on this point in the following language: "I place the utmost weight upon the tubercle bacilli, in proving the existence of phthisis. I may even say, more than any physician (? K.); for almost all physicians occupy a purely platonic position [I hope not!] regarding the tubercle bacillus and its relations to pulmonary phthisis, although they recognize it as the cause of tuberculosis. In practice one does not hesitate to declare an individual healthy, without having examined the sputum, because the physical examination of the lungs has proved negative. Phthisical patients are declared to be cured, likewise without the sputum being examined for tubercle bacilli and proof obtained that

such no longer exist. [I unfortunately must confirm this statement.—K.]

“But can we still say consumption of the lungs is cured without having demonstrated, besides other signs, that the tubercle bacillus has gradually become less in quantity in the expectoration and finally permanently disappeared? According to my view, such evidence is now a condition *sine qua non*; for what is the meaning of the doctrine: the tubercle bacillus is the cause of phthisis, and where the bacillus exists, there tuberculosis is present? The appearance of health is very relative, therefore very deceptive; it does not warrant us to consider the individual healthy. The residues, which, according to the severity of the case, remain behind, give grounds for the hope of recovery; but they do not justify our declaring the patient to be cured, so long as the sputum has not for months been free from bacilli and remained so. Only on these conditions do I declare a consumptive to be cured” (see p. 100).

The results of the investigations which I have made in a copious material of pulmonary diseases since 1883, and which in part coincide with the special investigations of Balmer and Fräntzel, Gaffky, Dettweiler, and others, are briefly stated in the following:

1. In the sputum of every consumptive (the greatest certainty is obtained by using the first sputum voided in the morning), the bacilli of Koch may be demonstrated.

2. If after repeated examinations, made at different times and as before described (p. 118), one is not able to demonstrate the tubercle bacilli, the bacillary nature of the pulmonary affection may be excluded.

3. The quantity of bacilli in the sputum does not stand in an absolute relationship to the severity of the affection (see “*Miliartuberculose und Larynxphthisis*”).

4. Rises of temperature do not demonstrably cause an increase in the number of bacilli in the sputum, and vice versa.

5. The quantity of the bacilli does not possess any prognostic value.

6. A cure is begun or completed with the temporary or permanent disappearance of the Koch bacilli from the sputum.

Next to the tubercle bacilli, it is the elastic fibres, the débris of the destroyed pulmonary tissue, which occupy our attention in the sputum of consumptives; concerning these,

the reader is referred to the portion of the work devoted to them (p. 108).

The chemical examination of phthysical sputum has as yet not yielded any material disclosures; it shows a composition similar to the sputa of catarrhal bronchitis, but shows, as regards the difference in the proportions, a dissimilar division of its constituents. The lowest figures were encountered in bronchitis, the highest in the last stages of phthisis. The investigations of Renk, which embraced three consumptives in the middle stage of the disease, who voided a mean average of 125 gm. per day, gave the following composition of the sputum: water 24 to 25 parts; solid constituents, 5 to 6; among the organic portions of which were 1.80 to 2.84 of mucin, 1.26 to 2 extractive matters, 0.2 to 0.49 albumin, and 0.30 to 0.52 fats; of the inorganic, 0.76 to 0.90 of chloride of sodium and phosphate.

Bokay³² determined quantitatively the organic substances in the sputum of a patient in an advanced stage of phthisis, and obtained the following figures:

The quantity voided in twenty-four hours was 25 to 30 cubic centimetres; (a) fatty acids of the fats, 0.9725%; (b) free fatty acids, 0.0902%; (c) fatty acids combined with an alkali, 0.3973%; (d) cholesterin, 0.0141%; (e) lecithin, 0.1245%; (f) nuclein, 0.0489%; (g) albuminous substances (serum-albumin and globulin, sparse; myosin, copious), 0.5115%.

The other diagnostic criteria of phthysical sputa, which were formerly regarded as essential, have been relegated to a subordinate position since the discovery of the tubercle bacillus; they can, however, aid us in determining the extent of the phthysical process. The gross scrutiny of the sputum, its extensive, lumpy form (nummular sputum), its uneven, eroded-looking upper layer, its quantity and color, its weight (*sputa fundum petentia*), etc., will give the practitioner additional information of the state of the disease.

Acute miliary tuberculosis, with rare exceptions, yields either no expectoration at all, or only a sparse, colorless, tenacious secretion.

II. THE SPUTUM IN PNEUMONIA.

The surmise that pneumonia, like other infectious diseases, is due to an individual poison, has for more than a dec-

ade been brought to our attention by clinical observation. The development of bacteriological research, and the perfection of the culture methods introduced by R. Koch, and the experiments upon animals associated therewith, would justify the expectation of an elucidation in this field of investigation.

In 1883 Friedländer and Frobenius succeeded, in a large number of cases of pneumonia, in finding and isolating those micro-organisms which I have described in detail in another place, and to which the rôle of producing pneumonia appears to belong. Although strict proof of their being the sole cause has not yet been obtained, and though, according to the researches of other observers, it appears as if besides the encapsulated Friedländer cocci, other organisms have similar pathogenic action, the clinical observations of Ruehle,⁴⁰ Ribbert,²⁴ Emmerich,⁴¹ and others justify the assumption that pneumonia is an infectious disease. How far in a concrete case the Friedländer coccus alone forms the etiological factor, or whether other pathogenic micro-organisms participate in its action, and in what way, it is for the present not possible to decide.

It has already been mentioned that A. Fränkel isolated from pneumonic sputum a coccus differing both morphologically and biologically from the Friedländer coccus, by the inoculation of which he produced hepatization. Guttman, who succeeded in cultivating a third coccus, differing from the preceding, does not consider the number of pneumonia-producers thereby exhausted. The future will have to furnish further enlightenment. It would be a very daring procedure, as recommended and practised by Ruehle, to base a diagnosis of pneumonia alone upon the presence of pneumonococci in the sputum, since similar-looking cocci undoubtedly appear in the sputa of individuals not affected with pneumonia; other data, as we shall see, are here much more important.

With a little practice in the technique of staining, one may readily succeed, in the incipient stage of the disease, in detecting Friedländer's cocci (bacilli, Flügge), especially in the fibrinous-exudate portions of the blood-colored sputum.

If we regard the sputa of a normally progressing fibrinous pneumonia according to its clinical stages, we must separately discuss the three types entering into it. As a rule they possess such characteristic signs as to alone suffice, in general, for the diagnosis.

In the first stage, that of engorgement, the sputa, if present, are very scanty, tenacious, adhesive from the large amount of mucin and albumin contained in them, confluent, transparent, and aerated, and forming a frothy layer upon water. The quantity of contained blood is generally moderate, the mixture not intimate, and indicated by a light-yellow color. These peculiarities are of considerable diagnostic import when the local symptoms are still ill defined, and the physical signs are lacking, as, *e.g.*, in the case of a central lobular pneumonia. Microscopically we see larger or smaller quantities of blood-discs in various pathological forms, occurring either singly in the field of view or lying in apposition, more with their borders than their surfaces.

If the pneumonia, after the third or fourth day, has entered upon the stage of progressive exudation, in which the exudate coagulates, the blood-corpuscles disintegrate, and the coloring matter of the blood emulsifies, in varying quantity in the mucus, then the sputa, owing to the increase of their morphological constituents (blood-discs and leucocytes), become opaque and tenacious. Patients expectorate the tough mucus with great exertion; the sputum possesses such coherence that it sticks to the vessel, and on the inversion of the latter remains upon its bottom, or the whole tenacious mass escapes in a lump. The intimate admixture of blood imparts to the sputum the appearance which has given it the name rusty or brick-colored. The shade of color is due to the quantity of the admixed blood-discs and their chemical transformation, further by the length of time the blood has remained in the alveoli or the fine bronchi. The brownish or even black sputa of older date has been compared to prune or licorice juice.

Besides these characteristic colors of pneumonic sputum, the latter may present still another appearance, *e.g.*, the grass-green color in so-called bilious pneumonia. This color is caused either by the addition of bile pigment and the transformation of cholepyrrhin into biliverdin by the access of atmospheric oxygen, or it is the green coloring matter of the last stage of oxidation of hæmatin similar to that occurring in contusions, where the same play of colors takes place under the skin. In the first case the bile pigment may be detected in the sputum by the familiar reactions. (The addition of a

few drops of fuming nitric acid induces the usual reaction, although it is not so distinct.) Traube and Nothnagel have, however, encountered grass-green sputa in pneumonia not complicated by icterus, which ended in lysis instead of crisis.

Saffron-colored sputum does not always, as Eichhorst¹⁷ con-



FIG. 14.—Large fibrinous coagulum from the rusty sputum of the patient referred to in Fig. 9; it was expectorated on the fifth day of the disease. (Author's observation.)

tends, point to the beginning of resolution; I have seen the light-yellow saffron color complicate the serous sputum of pulmonary œdema in a case of pneumonia which terminated fatally.

To what extent special micro-organisms (masses of lepto-

thrix?) are implicated in the coloring of the sputum must be elucidated by future investigations.

On examining the sputum microscopically, many red, partly disintegrated blood-discs and numerous pus-cells mixed with a few epithelial cells will be seen. With a little attention and patience it will not be difficult, under low powers, to find the dendritic branchings of the above-described fibrinous casts of the bronchioles, which on the addition of acetic acid swell up like jelly. The pneumonococcus generally lodges in these.

Another certainly rare discovery in pneumonic sputa are Curschmann's spirals (p. 115). Curschmann found them four times in twenty-seven cases of pneumonia, twice associated with fibrinous coagula. According to him, they result from two causes: either the individual has for some time suffered from chronic exudative bronchiolitis, which was superseded by acute fibrinous pneumonia, and shows the spirals in the rusty sputum as evidence of the chronic affection; or the individual was previously healthy, the exudative bronchitis accompanying the pneumonia as an acute affection, to disappear with the latter. The spirals are then generally very sparse and never contain crystals.

If the pneumonia tend toward a favorable termination, the sputum of the last stage will correspondingly change. The rusty color disappears, the sputum becomes lighter, more opaque, the fibrinous coagula are wanting or suffer fatty disintegration, the coherence diminishes, it "rolls" in the vessel and resembles almost completely the muco-purulent character of the expectoration in bronchial catarrh. The expectoration ceases entirely with recovery, or, more frequently, a short time after recovery a sparse, mucoid bronchial secretion is voided. If the pneumonia terminates fatally with the super-vention of pulmonary œdema, the sputum toward the close becomes thready or sero-sanguinolent, thin-fluid, and of "dark, dirty, red-brown" color (Guttman). It contains many air-bubbles in the form of froth, blood constituents, blood-discs, and serum, and has been designated as prune-juice (*jus de pruneaux*) by French authorities.

Quantitative and qualitative modifications in the character of the sputum are frequently produced by divergences from the normal course of pneumonia: in children and insane individuals, who swallow it, the sputum is lacking entirely, or the

color, consistence, etc., from the onset require a prognosis differing from the usual.

Abnormal terminations of pneumonia may also cause essential anomalies in the sputum.

If the pneumonia merges into the formation of abscesses, the deviations of the sputum from the normal alone suffice for diagnostic criteria. Considerable quantities of perfectly purulent sputa, intermixed with elastic fibres, and not seldom with hæmatoidin crystals paroxysmally voided, will admit no doubt in the matter.

If under special, still obscure circumstances (parasitic infectious influences?) the affection terminates in pulmonary gangrene, the sputa, mingled with fetid, dirty-colored shreds of pulmonary tissue in a state of putrid decomposition, will also establish the diagnosis.

The former view that acute pneumonia may terminate in chronic pulmonary consumption must be discarded. It must, moreover, be concluded that this view depended upon erroneous diagnoses, and that the affection regarded as a pneumonia was from the beginning of bacillary nature. Microscopical examination of the sputum makes such errors at the present time impossible.

III. THE SPUTUM IN PULMONARY GANGRENE.

Gangrene of the lungs is a necrosis of the pulmonary tissue. It is brought about by the action of schizomycetes, which enter the lungs partly through the air passages and partly by way of the blood-channels, and there induce local infection; the expression of this infection is necrosis. Rosenbach³⁰ was successful in cultivating a chain coccus, named by him streptococcus pyogenes, from this source, and by inoculation with it produced progressive gangrene. A recent work from the Pathological Anatomical Institute at Turin by Bonome⁴² attempts to prove the etiological significance of the streptococcus pyogenes aureus et citreus in the causation of pulmonary gangrene. It terminates in the conclusion "that in the investigated cases of pulmonary gangrene found in literature the infectious agent was the two microphytes mentioned."

Traube,⁴³ as early as 1864, designated the partly rod-shaped,

partly round vibrios found in the sputa of pulmonary gangrene as the excitants of the putrefactive process. Leyden and Jaffé⁴⁴ found such great masses of leptothrix that they could not regard them as simple mechanical admixtures from the mucus of the mouth, but as co-workers in the putrid decomposition. The same is true of the various monads found in the sputum (peach-blossom colored, putrefactive organisms).

In order to make a diagnosis of gangrene of the lung from

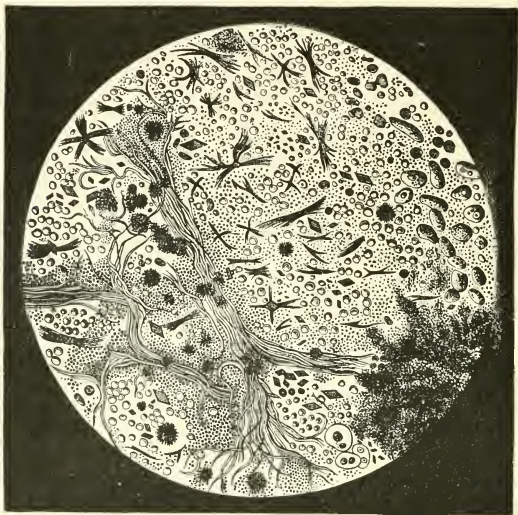


FIG. 15.—Sputum of pulmonary gangrene. (After Leyden.)

the sputum, one must be thoroughly acquainted with its characteristic features.

If communication has been established between the gangrenous focus and a large bronchus, and expectoration rendered possible, a large quantity (as much as two cubic centimetres) of foul-smelling, dirty-gray, greenish, or, in case it contains blood, greenish-yellow sputum is voided. After a time, the homogeneously expectorated sputum is prone to separate into three distinct layers in the vessel, the upper layer is frothy,

dirty yellowish-green, opaque, and contains single flakes of pus and mucus; the middle layer is strongly translucent, albuminous, almost serous, and permeated by stray flocculi, floating about in the fluid; the lowest layer forms a yellow, purulent, or brownish sanious sediment, composed of broken-up pus-cells and products of decomposition; the latter contain cork-like, very offensive crumbly masses, which present a villous or ragged appearance in water (Dietrich plugs). Microscopically they consist of a very finely granular detritus, mingled with larger fat-globules, within which needles of fatty acids, first observed by Virchow and described in another place, may be detected. In addition, the detritus contains smaller masses or heaps, which upon closer scrutiny or staining appear to be almost entirely composed of leptothrix or saprophytic elements.

Traube has called attention to a factor of great importance in the differential diagnosis between gangrene of the lung and other affections accompanied by destruction of lung tissue, namely, the absence of elastic fibres in the sputum. He surmises that they are rapidly destroyed by an unknown putrefactive ferment. As the sputum, by virtue of the development in it of fluid fatty acids, after some time shows acid reaction, it is probably that the acids dissolve the elastic fibres. Filehne and Stolnikow succeeded, by extraction with glycerin, in isolating from gangrenous sputum a ferment resembling trypsin, which is said to rapidly destroy elastic tissue.

Chemical examination of the sputum gives evidence of the presence of a great number of most diverse products, which form by the decomposition of albuminoid substances and fats. Future research must determine to what extent the poisonous basic bodies, caused by bacterial influences, the so-called ptomaines, are capable of detection, and what significance is to be attached to their presence in the sputum; it will be the task of bacteriological investigations to isolate by culture the various forms from the sputum, to test their specific nature, and give more complete explanations of other questions as yet shrouded in obscurity.

CHAPTER VII.

THE DISINFECTION OF THE SPUTUM.

SINCE the living organism offers an unsuitable channel through which to direct destructive attacks against bacteria, and since it is not possible for us to annihilate, before their discharge, the micro-organism known to be the indisputable producers of infection by any internal agents—in other words, to rid the body of poison—it should be our mission and unceasing endeavor to combat them externally and to remove them, or so to influence them as to frustrate their deleterious effects—in fact, to antagonize infectious disease by prophylactic measures. The investigations of R. Koch and his pupils have had the most momentous influence in awakening a recognition of this duty, and have led to the development and perfection of methods bearing upon the practical fulfilment of this object. From them we learn that the so-called disinfecting measures hitherto employed were ineffectual, and prevented neither the development of the bacteria nor their more dangerous spores.

Of the excrementary substance which may be the vehicles of pathogenic material, the sputum, next to the fæces, possesses the utmost significance. The sputum is the carrier of infection of one of the most destructive maladies—pulmonary consumption; the bacilli of Koch and their spores are thereby brought into the external world in innumerable quantities, and conveyed to others again under particular circumstances.

We need not enter upon the much-discussed and still undecided question as to how the bacilli or the spores capable of development enter the body. The facts that both are contained in the expectoration; that they retain their infectious quality after being kept for months in a dry state; that nearly one-seventh of all living people are phthisical, and discharge their poison-laden sputa externally, where abundant opportu-

nity exists for their drying up and mingling with the ever mobile dust, speak clearly enough for their importance and diffusion.

With this so-called ubiquity of the sources of infection, principally rendered possible by the sputum, and the duty it imposes upon us of adopting general protective measures, such as isolation of the sick, ventilation, lessening the disposition (conferring immunity), etc., we must, first of all, attempt to grapple with the enemy in its lair, the sputum, and to destroy it.

“*Principiis obsta, sero medicina paratur.*”

The method of disinfection, as practised by Schill and Fisner⁴ in the Imperial Health Office under the direction of Koch, is briefly as follows:

For larger objects, which are exposed to becoming soiled with sputa, as bedsteads, bed and body linen, handkerchiefs, etc., of consumptives, dry heat alone will not suffice; the practice, therefore, which generally prevails of conveying the objects into hot baking ovens for cleansing is insufficient. For this purpose the action of steam at the temperature of 100°C., for larger objects for an hour, for linen and clothing for half an hour, is necessary, as available in the diverse practical and effective disinfecting apparatus now offered the profession. [The Imperial State government has had a large Schimmel disinfecting apparatus erected at Bad Rehburg, which all landlords are compelled to use, as regulated by special rules.] Linens, feather-beds, mattresses, clothing, prints, etc., remain fully intact under this treatment—a fact generally disputed by the laity. The only exceptions are leather (shoes), rubber and cautchouc wares, furs, and book-binding. Fresh bacillary sputum is disinfected in about fifteen minutes, dried sputum in about thirty minutes to an hour.

Of chemical bactericides, carbolic acid has alone proved efficient for disinfecting the sputa. The addition of a 5% solution in equal proportion to the quantity of sputum suffices for the certain destruction of the bacilli and spores after twenty-four hours' contact; for the disinfection of a quart of sputum, therefore, 50 gm. of carbolic acid are necessary.

The employment of sublimate solutions (1:1,000), which in general possesses the strongest bactericide properties, is not to

be entertained, as the sublimate enters into combinations in fluids containing albumin, and does not remain in solution in sufficient quantity.

We, therefore, possess in carbolic acid a sovereign means, which commends itself, besides its certain action, by its cheap price, and renders its introduction in daily practice vastly more feasible.

It is hoped that all those who in the midst of practical life retain a warm interest in hygienic efforts—the country doctors, the teachers, the heads of learned institutions—will instigate all those coming within the scope of their humane professional duties, to preach and explain the proper conception of the hygienic importance of the sputum and its disinfection. In this manner, according to the wish of Virchow, “a part of the mission of humanity to overthrow tuberculosis as scorbutus has been overthrown, would be fulfilled.”

CHAPTER VIII.

PRACTICAL METHODS FOR THE EXAMINATION OF SPUTUM FOR TUBERCLE BACILLI.

SINCE I have been engaged in the examination of the sputa of patients with pulmonary diseases for the bacilli of Koch, a large number of inquiries have been made of me by colleagues, who from time to time had sent me sputa or preparations for investigation; I therefore gained the conviction that only a very detailed description of the technique of the examination would enable practitioners to acquire that satisfactory dexterity which, in the differential diagnosis between tuberculous (bacillary) pulmonary diseases and other forms, will exclude all doubts. Every one who is much engaged in this form of sputum investigation will be desirous of perfecting whatever skill in this regard he may possess; of course, however, on the basis and plan of the original Koch method and its modification by Ehrlich.

While the author is conscious that he is not in a position to offer any essentially new points, he cherishes the hope that the full description of manipulations so far tested and approved by individual experience may serve as a useful guide and welcome aid to many seekers after light.

The direct microscopical examination for small fungi (schizomycetes) was beset with many difficulties while we lacked a knowledge of staining methods, so that it was only possible to demonstrate their existence from the form of the single micro-organism and its characteristic aggregation in properly prepared specimens. It was not until the methods of staining were successfully cultivated in the examination of micro-organisms, particularly by Weigert, R. Koch, Ehrlich, and others, that a proper differentiation was rendered possible and we are now enabled to make nearly all known micro-parasites accessible to investigation by their reactions to staining.

Compared with other schizomycetes, the bacillus of tuberculosis requires special treatment, as it possesses specific peculiarities with reference to the staining-method employed.

R. Koch, to whom is due the great honor of having discovered the method for detecting the bacilli, by numerous experiments came to the conclusion, first, that only definite basic anilin colors were suitable for staining fungi, and, secondly, that the reaction of the staining fluid was decisive for the tubercle bacilli, or, in other words, that the tubercle bacilli would take on the aniline stain only in the presence of alkalies. He⁴⁵ subjected cover-glasses containing bacillary sputum to the influence of a coloring fluid of the following composition:

"Two hundred cubic centimetres of distilled water were well shaken in 1 cc. of concentrated alcoholic solution of methyl blue, with the addition, during continued agitation, of 0.2 cc. of a 10% potash lye. This mixture, even after standing for days, must not yield a precipitate. The cover-glasses remain in it from twenty-four to forty-eight hours. They are then rinsed in a concentrated watery solution of vesuvin, which must be filtered before each use, and after one or two minutes are washed in distilled water until the blue color has disappeared." In such preparations everything is now stained brown, with the exception of the rod-like bodies, the tubercle bacilli, which retain their blue color with remarkable tenacity. This, according to Koch, is due to the fact that certain aniline colors possess the peculiar property of mutually supplanting one another—in this case, methyl blue by vesuvin.

Ehrlich, who sought to simplify the procedure of Koch, found a suitable substitute for the potash-lye in aniline oil (a mixture of two similar bases of aniline, toluidin and pseudo-toluidin), a brown or yellowish oily fluid, the saturated watery solutions of which will dissolve more coloring matter than dilute potassium solutions. Based on his investigations, he presents the hypothesis that the bacilli are surrounded by envelopes pervious under alkaline reaction, but impervious to acid media. Proof for this statement is that stained preparations after rinsing in nitric acid become entirely decolorized; the bacilli, on the other hand, access to which by the acid is prevented by the surrounding envelope, retain their color. The modified method of Ehrlich was as follows:⁴⁶

"He pressed a particle taken from the sputum with needles

between two cover-glasses of 0.10 to 0.12 thickness in order to obtain a uniform thin layer. After he had allowed the preparation to become air-dry, he drew it by means of forceps three times through the flame of a Bunsen gas-burner. For staining, he makes a saturated aniline water by agitating water with an excess of aniline oil, and filters it. To the transparent fluid so obtained, he adds, drop by drop, a saturated alcoholic solution of methyl-violet or fuchsin, until the fluid becomes distinctly opalescent, which indicates saturation. He allows the cover-glasses to float upon this fluid for a quarter to half an hour. Instead of vesuvin, he employs an acid mixture (1 volume of officinal nitric acid and 2 volumes of water), by the action of which after a few seconds the preparation becomes blanched or white, and only the bacilli retain their blue color." This procedure is superior to that of Koch in that it is more expeditious, and as Ehrlich believes, also because of the greater number of bacilli presenting themselves. The method of Koch was therefore discarded, and is now only occasionally employed for comparative purposes.

Several months after Ehrlich's publication, Ziehl⁴⁷ denied the view of the former that the envelope of the bacilli was only permeable to coloring matters by the aid of alkalies, and substituted carbolic acid for the aniline oil, which, according to him, possessed, like aniline oil, substances belonging to the aromatic order, of definite reaction.

Although, as I have convinced myself by numerous experiments, the method with carbolic acid is successful, results are more quickly obtained with aniline oil, a fact conceded also by Ziehl.

Balmer and Fräntzel⁴⁸ recommend further immaterial modifications, namely to allow the cover-glasses to float in the methyl-violet aniline-water solution for twenty-four hours, then to immerse them for one-half to one minute or until completely decolorized in a nitric acid solution (1:3), and after washing in distilled water, to place them for half to one minute in a concentrated watery solution of Bismarck brown for staining the field.

Every one who has to make such investigations for diagnostic purposes daily, knows how important it is for the busy practitioner to possess a method which combines at once the greatest celerity with the utmost reliability. From this

standpoint Rindfleisch⁴⁹ recommended his pupils to proceed as follows:

"As much aniline oil is poured into a flask as will fill up the opening to the fundus, it is then filled one-third full with water, the aniline oil and water thoroughly agitated, and at once filtered through a filter carried in the free hand into a second flask; eight drops of a concentrated alcoholic solution of fuchsin are added to the filtrate; then the operator places before himself: 1, a watch-glass half filled with spirit to which two drops of dilute nitric acid are added, placed upon a piece of white paper; 2, a watch-glass half filled with the above-mentioned solution of fuchsin; 3, a burning spirit lamp. The cover-glass upon which the suspicious sputum has been dried is now grasped at its edge by a pair of forceps, and drawn three times, about as rapidly as one cuts bread, through the flame of the spirit lamp, the sputum-side up; the albumin is by this made homogeneous for further manipulation. The cover-glass is now laid upon the staining fluid free side up and allowed to float; the watch-glass is then grasped with the forceps and held over the flame until the fluid begins to give off vapor. After this the cover-glass is removed from the fluid with the forceps, washed off in a handy cup of water or under a stream, and immersed in the acidified spirit. Here very soon violet clouds liberate themselves from the preparation, and after ten or fifteen minutes the glass, with the exception of a few traces, appears decolorized. It is now removed with the forceps, at once again rinsed in water, dried, and mounted in Canada balsam. In the examination the highest power is used and all glare of light avoided."

In July, 1883, Orth, of Göttingen, published "*Notizen zur Färbetechnik*,"⁵⁰ in which he recommended muriated alcohol (1:100, 70% alcohol) for washing out stained preparations, "because it acts better than nitric acid, attacks the preparations to a lesser degree, and is more agreeable than the latter in manipulations."

The most recent modification of Ehrlich's procedure is described by Petri-Gorbersdorf.⁵¹ He considers the aniline oil superfluous, and employs instead blue or brown aniline colors with fuchsin or malachite green, and does not decolorize with mineral acids, but with glacial acetic acid. The author, after several hundred sputum investigations since Koch's publica-

tion, according to the different methods described, has come to the conclusion that, from a practical standpoint, a combination of Ehrlich's method, with some modifications recommended by Rindfleisch and Orth, is the most expeditious and certain, and that the preparations produced thereby are the best, and so permanent that after eight months' keeping they have lost nothing in distinctness.

In general, the author believes himself justified in declaring that of all aniline colors gentian violet is the most serviceable for staining tubercle bacilli. From this substance an alcoholic solution should be prepared so concentrated that it will show an excess of coloring matter. For decolorizing, the author uses a mixture of 100 ccm. 90% alcohol, 20 ccm. water, and 20 drops of concentrated muriatic acid, with subsequent rinsing of the preparation in 90% alcohol; for after-staining, by which the bacilli stand out in characteristic manner, he employs a concentrated watery solution of vesuvin. The bacilli present themselves now as dark violet rods, occasionally slightly bent or in the process of forming spores, upon a brown background. As a matter of course, the most careful scrutiny of every individual particle of the preparation is requisite for detecting the bacilli. Specimens thus prepared, as already mentioned, may be preserved for considerable periods. This keeping property may be explicable by the employment of muriated alcohol instead of nitric acid, and thus substantiate the statement of Brun,⁵² according to which the nitric acid remaining behind in the preparation is the cause of the bacilli finally losing their color. Whether Canada balsam, damar-resin, or glycerin be used as the preservative medium, depends upon individual predilection; when, however, Orth declares that bacilli kept in Canada balsam lost color because of the chloroform contained therein, I must dispute this view upon the ground that my own preparations, which have been mounted in Canada balsam for eight months, have not lost a vestige of their original color. One can, too, as I have tried it, allow dried preparations to lie for months without the addition of preserving fluids and still be able to detect the bacilli plainly.

Regarding the microscopical examination, I cannot concede that an investigation under a power of 300 to 400 diameters is sufficient. Although it may be possible for the practised eye

to work with this power, in general, and particularly where a small number of bacilli are present, apart from the great saving in time, an immersion lens and an Abbé condenser must be regarded as indispensable for securing accurate diagnosis.

Attention should also be called to the fact that the quality of the dyes is not always uniform, and possibly this will partly explain the non-success of many colleagues. Another cause of failure appears to me to be due to the fact that the layer of sputum is too thick and too irregularly spread upon the cover-glass, it may also not be superfluous to advise the investigator, in order to gain certainty, to prepare several specimens of one sputum. The question as to how long the bacilli may be demonstrable in bacillary sputum may be answered by the statement, also made by Koch,⁵³ that dried sputum shows bacilli eight weeks after being voided, and that I have identified numerous bacilli and spores in fluid phthisical sputum now five weeks old.

Based upon the preceding explanation, I would formulate my procedure for the certain, rapid, and thorough staining and detection of tubercle bacilli, in the following order:

1. Spread out a quantity of sputum upon a dark object, preferably a blackened plate, and pick out by means of platinum needles (always previously sterilized) an opaque white or grayish-white particle.

2. Spread out, or better still, rub this particle until dry between cover-glasses of 13 to 18 mm. thickness, so that a uniform thin layer becomes fixed; the layer must be about as thin as that required for examining the blood (Friedländer). The cover-glasses are not to be lifted, but drawn apart.

3. Slowly draw the cover-glass four times through a spirit flame of moderate intensity, "about as rapidly as one cuts bread."

4. Shake good aniline oil for several minutes with distilled water about in the proportion of 5:100, then filter through moist paper into a porcelain capsule (aniline water).

5. Add (to solution No. 4) a filtered supersaturated solution of gentian violet in 90% alcohol, enough to cause decided opalescence, and stir with a glass rod. About 15 drops of staining solution are requisite for 10 ccm. of aniline water.

6. Either allow the prepared cover-glasses to float 24 hours

(longer does no harm) upon this staining solution, or the capsule with the cover-glasses (the author generally makes six preparations from one sputum at the same time) is placed upon a tripod with a wire net having a spirit lamp underneath, heated with a moderate flame until crackling bubbles form on the fluid, or, more accurately, to 80° C., and allowed to stand for several minutes.

7. Removal and preparation in the following order: After the cover-glass has been removed with the forceps, the superfluous staining solution is removed with a piece of blotting paper; then immersed in a capsule filled with muriated alcohol (100 ccm. alcohol, 20 ccm. distilled water and 20 drops concentrated muriatic acid) for about a half to one minute; then stirred in a capsule containing only 90% alcohol until the last remnant of the blue color has disappeared (one to two minutes), and finally thoroughly washed with distilled water.

8. The cover-glass, specimen side up, is now laid upon blotting paper and allowed to dry. If the latter is to be accelerated, it may be most effectually accomplished by blowing through a glass tube. Then drop upon it with drop counter or a Lambert drop-glass, four to five drops of a concentrated watery solution of vesuvin. (In preserving this fluid, the addition of a small piece of camphor will prevent moulding.) After two minutes, thoroughly wash in distilled water, dry the preparation, remove it to a slide of white plane glass about 1 to 2 mm. thick and examine in a drop of distilled water, or, if it is to be preserved, mount it at once or later on in Canada balsam or damar varnish.

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HYPNOTISM.

ITS SIGNIFICANCE AND MANAGEMENT
BRIEFLY PRESENTED.

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HYPNOTISM.

CHAPTER I.

GENERAL REMARKS.

FACTS, theories, notions, and terminology are unfortunately thrown together in a state of terrible confusion in the field of hypnotism, as in everything that pertains to psychology.

Data.—The chief fact in hypnotism is the changed condition of the mind (or condition of the brain when viewed from the physiological, that is, the objective side) of an individual. To distinguish it from ordinary sleep, with which this condition presents great similarity, it may be called hypnosis. The second series of facts consists in the mode of production (or removal) of this condition. Here false interpretations have given rise to the most erroneous conceptions. Hypnosis may be produced apparently in three ways: *a*, by the physical action of one individual upon another by means of ideas which he communicates to him. This mode of hypnotization has been called suggestion (Nancy School); *b*, by the direct action of living or inanimate objects or of a mysterious agent, upon the nervous system, in which a great part has been ascribed to exhaustion by a long concentration of a sense upon one point; also by the specific action of magnets on the human mind; of drugs inclosed in bottles, and the like; *c*, by the reaction of the mind upon itself (auto-hypnotism). In complete unison with Bernheim I think it may be maintained that in reality only one mode of production of hypnosis has been established scientifically, namely, its production by ideas (whether by the suggestion of another or by auto-suggestion). The possibility of suggestion or auto-suggestion has not been excluded with scientific certainty in any of the other assumed or apparent modes of production of hypnosis.

The third series of facts is that of the actions of the hypnotized. It is settled that in this condition by means of suggestion, the most extensive reactions upon almost all the functions of the nervous system (with the exception of a few spinal reflexes and ganglionic functions) are possible—including such bodily functions as digestion, defecation, menstruation, the pulse, redness of the skin, etc., whose dependence upon the cerebrum has been forgotten commonly or under estimated.

The more or less complete dependence of the mental activity of the hypnotized upon the suggestions of the hypnotizer is also undoubted. Finally, and of the greatest importance, is the certainly established fact that the action exercised in hypnosis may extend post-hypnotic to the normal condition of the mind in its entire domain, and that this may occur for a long period, including the influence of the hypnotizer upon the hypnotized.

Doubtful, on the other hand, or at least, not explained or ascertained with sufficient scientific certainty, are the so-called super-sensual facts, such as so-called clairvoyance, the action of drugs in closed bottles, the so-called direct transmission of thought, and the like. In the extremely rare somnambulists in whom these experiments are said to succeed, a strictly scientific control which excludes all possibility of unconscious suggestion usually appears to have been absent, and when present the complete fiasco of the experiment seems to have been the ordinary result. Nevertheless, this question must be regarded as an open one and as worthy of careful investigation, because a series of statements of trustworthy individuals of good judgment answer it in the affirmative.

Theories and Conceptions.—The conceptions entertained concerning hypnotism depend upon the theoretical views which prevailed concerning it. If we throw out, as far as possible, the ballast of undigested and superstitious nonsense which has been furnished in regard to the question under discussion, there remain on the whole three distinct theories or explanations of the facts which have been briefly mentioned above.

1. An external invisible agent (a fluid, as it was formerly called, and as the laity call it up to the present time; a yet unknown natural force, as it would be called in modern language) enters the body, especially the nervous system, influences the organism and communicates to it something foreign

—perhaps even the knowledge of inanimate nature or of other living beings. Or the thoughts, the mental processes of another individual, without the medium of communication by speech, writing, or signs on the part of the first individual and of the sense organs of the second, pass, by means of such an agent, to the cognizance of the mind of another individual. This is Messmer's theory. Messmer called the supposed agent magnetism, or animal magnetism, when it appeared to be derived from the human organism itself (from that of the magnetizer). This theory, which still has enthusiastic, even fanatic adherents in certain circles, is based upon the phenomena which, under the heading "*b*" have been called "doubtful super-sensual facts." It is clear that if this were true, our scientific knowledge would have to be restricted considerably, because the previous ignorance of this unknown something, this unknown force, by science, necessarily would entail errors in our previous knowledge, as would a forgotten important component. But inasmuch as science, by its colossal practical results, daily furnishes more and more the proof of its inner truth, we have every reason to mistrust Messmer's theory and to demand of it undoubted, incontrovertible proofs. Let us see what is really the case.

Messmer and his school were so thoroughly controverted by Braid and Liébault, in regard to the undoubted facts first mentioned (see below) that it would be useless to waste another word concerning them. The fluid theory fortifies itself at the present time behind the assumed facts which are championed by the spiritualists, and which, according to the circles in which they are produced, are permeated to such an extent by blind fanaticism, by mental disturbance (hallucinations), by misunderstood suggestion, by fraud and by superstition, that a scientific test is extremely difficult. The spirits and fourth dimension of the spiritualists are conceptions which would correspond to this unknown agent. A series of apparently supernatural phenomena, as we have already remarked, is constantly being adduced again and again by honest, trustworthy individuals, and which would favor Messmer's theory or allied theories. I mention the so-called transmission of thought, also called briefly mental suggestion, clairvoyance, the seeing or divination of processes occurring in a remote locality, the so-called presentiments and prophecies, etc. A

remarkable book in this respect is "Phantasms of the Living" by Gurney, Myers, and Podmore, in 2 vols., 8vo, Truebner, London, 1887. No less than 600 observations of visions, dreams, presentiments and the like, which were fulfilled are here collected. Concerning the authenticity of the sources of these statements, careful examination was made and only clear statements of trustworthy individuals were accepted. A review of this work is found in the "*Revue des deux Mondes*," May 1st, 1888. Every individual, in the circle of his acquaintances, will stumble across several such observations in thoroughly reliable people. Vide also Liébault, "*Le Sommeil Provoqué*," 1889, p. 295. Interesting, furthermore, are the experiments of Charles Richet ("*Revue Philosophique*," 1884), who attempts to prove the influence of the thought of one individual upon the thought of another in a definite direction, without any external phenomena which can be perceived by the senses. As it seems to us, however, the proofs are very incomplete, and the calculation of probability employed is not very convincing. The results of the Society for Psychical Research in England appear to be more positive. But in all these experiments it is extremely difficult, apart from accident and fraud, to exclude with certainty self-deception of the hypnotized or the subject (perhaps also the hypnotizer) and particularly, to exclude all unconscious suggestion or auto-suggestion, so that these results must be accepted with the greatest caution.

2. Diametrically opposed to the first-mentioned theory is the notion of suggestion, formulated originally by Braid, but first grasped in its entire significance and its practical results by Liébault in Nancy ("*Du Sommeil et des États Analogues*," 1866). This may be formulated after the following fashion:

Production of all the phenomena of hypnosis by the induction of the corresponding ideas, especially of conceptions of the imagination. Here it is to be remarked that the purpose is effected most readily and certainly when the hypnotizer by means of speech declares with positiveness that the condition to be produced is present at the very moment when he expresses it, or will develop at once (verbal suggestion). If an individual convinces himself, we speak, with Bernheim, of auto-suggestion. But even Braid did not recognize sufficiently the full bearings of suggestion, and in its stead attributed excessive importance to the continued stimulation of the senses

(fixation, etc.) By means of suggestion sleep is usually first produced and inasmuch as the sleep condition of the brain considerably increases its suggestibility (*i.e.*, its susceptibility to the influence of suggestion) we obtain the desired power at once. But suggestions result not alone from speech but also from everything that can produce conceptions, especially from everything that produces vigorous images of the fancy. Liébault (p. 347, *op. cit.*) correctly writes:

“The disposition to fall into these conditions is proportionate to each one’s faculty of mental representation. We may be sure that the man who, in concentrating his attention upon an imagined idea (for example, that of a tactile perception), does not fail to perceive it as if it were actual, is capable of sleeping deeply (*i.e.*, of being deeply hypnotized).”

Still more, a suggestion may occur unconsciously, or the corresponding conception may appear so feebly or for such a short time in consciousness, that it at once disappears from it forever, inasmuch as conscious memory can never recall it, although this suggestion acts powerfully. On account of the complete amnesia in such cases, as a general thing, it cannot be proven that the conception in question was ever a conscious one. Yet closer examination shows that it was undoubtedly present. Herein lies the crucial point for the comprehension of an immense number of self-deceptions and so-called Mesmer’s effects. A country girl who was hypnotized for the first time and who had no knowledge of physics and prisms, has a prism placed before her eyes during hypnosis after she had been allowed to look, by suggestion, at a candle in the air which was not present. She is then asked what she sees, and answers “Two candles.” This, as Bernheim has demonstrated, is an (unconscious) suggestion. Through the prism the girl saw the real surrounding objects in the room double, and thus unconsciously suggested that the suggested candle was also double. If the experiment is made in a perfectly dark room with an individual who has never been hypnotized and who is not conversant theoretically with the facts in question, the suggested image is never doubled by the prism (Bernheim). It is hardly to be assumed that the girl during hypnosis was conscious that the candles were seen double, because all at once the other objects were seen double. This duplication occurred instinctively, automatically, below the level of conscious-

ness. The other objects were not fixed by her (but only the fictitious candle). Nevertheless its duplication was perceived and utilized (very probably unconsciously). But the mechanism of suggestion, that is, the manner in which the heard and understood words of the hypnotizer (or the perception itself) produces the actual result, always remains unconscious.

Liébault's suggestion theory of hypnosis, by its practical results, especially in medical therapeutics, but also in education and in many other fields, has given such striking proofs of its truth, that its victory can now be regarded as perfectly assured. While other theories, with their corresponding methods, were only able to produce a part of the symptoms of hypnosis in a few hysterical or nervous individuals—exceptionally in a few healthy ones, with more or less trouble—and, at the same time, were constantly confronted with riddles and contradictions, and were compelled to resort to the most astonishing and obscure attempts at explanation, suggestion succeeds easily in almost every healthy individual, and explains everything from a single standpoint, with the exception of the facts mentioned above as doubtful. The number of mentally healthy individuals hypnotized in Nancy alone by Liébault and Bernheim amounts to several thousands. In 1887 Dr. Wetterstrand, in Stockholm, subjected 718 persons to suggestion, of whom only 19 remained uninfluenced. In three months Dr. Van Renterghem, in Amsterdam, successfully hypnotized by suggestion 162 individuals out of 178, and effected 91 cures of various diseases. Fontan and Ségard, in Marseilles, had very few failures in about 100 individuals. Despite my extreme pre-occupation by other duties, I have been able, in a little more than a year, to subject 205 individuals to suggestion, among them a number of insane. Of these 171 were influenced; 34 were not. Of the 105 persons last hypnotized, however, only 11 remained uninfluenced. Three individuals whom formerly I was unable to influence, were recently hypnotized with ease. Dr. Ringier, a physician in Canton Waadt, who studied the suggestion method with me last summer, attempted suggestion in a short time in more than 60 individuals, and of these only three or four were unsuccessful. Among all these hypnotized persons are a large number of perfect somnambulists with post-hypnotic phenomena, etc. How different are these numbers from the few hysterical pa-

tients of the Salpêtrière in Paris, not much more than a dozen, who for years have been demonstrated to every one, who serve as the basis for Charcot's theory, and have evidently succumbed to the most complete automatism of suggestion. If we grasp what has been said, it appears evident that the hitherto confused notion of hypnotism must disappear in the notion of suggestion. Herein lies the key of the greater part, perhaps of all, of the phenomena under discussion.

3. As the so-called somatic theories of hypnosis we may group together all those which, as it were, form the link between the two mentioned. No fluid or spirits are conjured up, it is true, but the attempt is made to attribute a part, if not all of the symptoms of hypnosis to known elementary forces without the medium of mental activity. A principal part is attributed to the action of peripheral stimuli (from without) upon the nerve terminations, so that, in part, the necessity of an external agent again becomes prominent. It is especially the School of Charcot or of the Salpêtrière which believes in the direct hypnogenous action of metals and magnets upon the nervous system (without the medium of conceptions); which believes in *transfert* (jumping of a paralysis, catalepsy, hemi-anæsthesia, etc., from one side of the body to another by the action of magnets); in the direct stimulation of the motor cortical centres of the brain, by stroking the scalp, etc. This school believes that by different peripheral mechanical irritations (1, fixation of the gaze; 2, raising off the lids; 3, stroking of the forehead) typically distinct stages or forms of hypnosis, namely, lethargy, catalepsy, and somnambulism, can be produced with specific reactions of the muscles and sensibility. It is important to note that Charcot's school believes that in so-called lethargy, the hypnotized are entirely unconscious and cannot be influenced by the suggestions which are conveyed to them by conceptions through the medium of the organs of sense. This school also believes that hysterical individuals are almost the only ones accessible to hypnosis and regard hypnosis as a neurosis. Bernheim, in Nancy, has demonstrated most conclusively to what confusion of thought this theory gives rise. All the facts which for years have been demonstrated at the Salpêtrière upon the few prepared hysterical individuals, are easily explained by old, in part unconscious, suggestions, inasmuch as, for example, the assumed

lethargic individual undoubtedly hears and mentally utilizes everything that is done or said in his presence. Braid's fixation of a shining object, to which so much importance is attached in Paris and in Germany, in itself produces no hypnosis. If any one is hypnotized by this unsuitable method it is done by means of the notion that this procedure will cause sleep, not by the procedure itself, which, *per se*, usually produces merely a nervous excitement (sometimes hysterical attacks in hysterical individuals); at the most, in a few of these cases, a tired feeling, and thus the falling of the lids may act as an unconscious suggestion.

It was formerly the general custom to awaken hypnotized individuals by blowing upon the face. For a long time I have not done this, and instead, have often associated the blowing with the suggestion of the disappearance of headache, etc. Hence, I may blow upon the face of my hypnotized individuals as much as I please without awaking them. This is also an argument against the assumed action of such mechanical stimuli on the part of the Somatic school, which regards the blowing as a specific waking irritant.

Liébault himself ("Étude sur le Zoömagnétisme," Paris, chez Masson, 1883) published 45 cases, in which, in little children, he claims to have obtained wonderfully favorable results by placing both hands upon a diseased part. In 32 of these cases the children were under three years, whence Liébault himself believes that suggestion may be excluded. They include several cases of whooping cough, with really astonishing curative results. Yet unconscious suggestion does not appear to be completely excluded in view of the enormously suggestible nature of children. Nevertheless, these observations remain extremely remarkable and are worthy of thorough investigation.

Chazarain and Dècle ("Le Courants de la Polarité dans l'Aimant et dans le Corps Humain") believe they have discovered a polarity of the human body, and attribute hypnotic phenomena as well as the results of so-called metallo-therapy to them. Suggestion and auto-suggestion can be excluded still less than in Liébault's children, and least of all, if we read the author's superficial observations, almost all of which appear to me to be suggestions of hysterical individuals.

Finally, mention is to be made of the assumed action of

drugs at a distance, or by the application of hermetically sealed bottles to the neck, etc. (Luys and others). But these results, which were proclaimed by Luys with great *éclat*, made a miserable fiasco before a commission of investigation, when all unconscious suggestions were prevented. They show with what want of criticism the experiments had been conducted and how nothing had been done to exclude the possibility of suggestion, that explains everything.

At the wish of my friend, Prof. Seguin, of New York, I have recently performed with his aid Luys' experiments with the closed medicine bottles, upon four of my best somnambulists. Prof. Seguin had seen Luys' experiments. The result was absolutely negative, as I confidently expected. The only interesting feature was the following: A hypnotized woman who had an alcohol bottle on her neck, and had previously stated that she felt nothing, was asked whether she did not have a headache. This was answered in the affirmative. Then, if she was not dizzy, as if drunk, and this was also answered in the affirmative, and was followed by symptoms of drunkenness. Hence it appears that a single insinuating question may act suggestively. I need not add that I also produced all symptoms of the corresponding drugs (even vomiting) by suggestion with wrong or empty bottles (as a control experiment).

If we make a *résumé* of the third group of theories which are said to be somatic and rational, it is found that they are the most unfortunate of all and produce the most dire confusion, and that all the facts claimed for them can be explained by suggestion. Liébault's results in children at the most form a noteworthy exception. The chief error in these theories is that they depend for their results chiefly upon observations on hysterical people. But the latter are, in the first place, the most unreliable; the best, because the most unconscious simulants and actors, and at the same time those individuals who often have the finest special senses and at the same time possess a considerable plastic imagination which makes them very suggestible, particularly auto-suggestible (usually unconsciously or only semi-consciously). At the same time, it is also forgotten that the psychical processes are somatic.

We thus have only one theory, namely the suggestion theory of the Nancy school, which harmonizes with the scientifically established facts of hypnotism and explains them satisfactorily.

Everything else is still immature or doubtful, or depends upon the misunderstanding of certain phenomena which are yet obscure and await a strict and methodical investigation.

Hence we have to deal only with the notion of suggestion and of suggestive sleep, as coördinate with that of hypnotism.

Terminology.—The expressions animal magnetism and mesmerism must be left to the fluid theory. The term hypnotism (Braid) may be applied to the entirety of the phenomena associated with conscious and unconscious suggestion. Hypnosis best defines the changed condition of the mind of hypnotized individuals in suggestive sleep. The hypnotizer is that individual who produces the condition of hypnosis in another. The term suggestion we apply, according to the Nancy school, to the production of a dynamic change of the nervous system in an individual (or of such functions which depend upon the nervous system) by another individual by means of conveying the conviction, conscious or unconscious, that this change occurs, or has occurred, or will occur. Verbal suggestion is suggestion by spoken language. Suggestibility is the individual receptiveness for suggestions. There are very many individuals who are suggestible in the waking condition. In them the notion of hypnosis can hardly be limited, because their normal condition in waking passes into the condition of hypnosis by imperceptible gradations. Auto-suggestion (Bernheim) is the suggestion which an individual produces consciously or (usually) unconsciously in himself.

The notion of "suggestion" and especially "auto-suggestion" may easily be enlarged to too great an extent, and made synonymous with the notion of instinct, habit, reflex, automatism. In fact, the distinction is difficult. The notion of suggestion may be better defined by including the active suggesting hypnotizer (the association of one individual with another). But if the hypnotizer acts unconsciously (when the suggestion is made to another by my yawning, for example) or when the suggestion is made by objects, the notion passes into that of auto-suggestion. The latter runs the risk of being extended so as to give rise to confusion and misconstruction of former truths and investigations. I will content myself with this hint.

Suggestion and hypnosis as phenomena and potencies are as old as the history of man, probably even much older phylogenetically. Entirely new are only two additional factors: 1,

the recognition of these phenomena, of their conditions, cause, their range in the consciousness of mankind, especially scientific mankind, and no longer as doubtful mysticism, but as scientific truth; 2, the remarkable facility with which hypnosis can be produced by Liébault's method in almost every individual. These two factors, it may be remarked in passing, also give to hypnotism a new criminal significance.

CHAPTER II.

SUGGESTION.

Hypnotizability.—In the “Revue de l’Hypnotisme” (May 1st, 1888) Bernheim says: “Every hospital physician who, in his hospital service, is unable to hypnotize eighty per cent of his patients, should say that he has not yet sufficient experience on the subject and should refrain from a hasty judgment.”

This statement I subscribe to completely, and with it agree thoroughly the above-mentioned statistical data. Insanity must alone be excepted.

Every individual is more or less suggestible, and thus capable of hypnotization. Many, it is true, plume themselves upon believing only what is clearly and consciously proven by reason, or, at least, is made very plausible. But they only prove by this that they are lacking in the most elementary self-criticism. Involuntarily and unconsciously we believe constantly in things which entirely or in part are not real. For instance, we believe in the reality of our sensory perceptions, which are only subjective conclusions. Every individual makes mistakes; trusts other individuals, statements which do not justify his confidence, etc., etc. These are proofs of our intuitive faith, without which thought would not be possible. If we waited until every motive of our thought and action were proven mathematically or only by sufficient induction before acceptance, we would never arrive at real thinking or action. But we can neither think nor act without possessing a certain feeling that our thought and action are correct, without believing more or less in them. Herein lies the key to suggestibility.

When we wish ardently for something that we do not possess, the opposed notion of the unattainability of our desire not infrequently develops so much more intensely. This psychological condition is especially evident when wishing for sub-

jective feelings. If we try to force them they flee from us. The one who attempts to sleep with consciousness and at all hazards becomes sleepless. The one who attempts in the same way to perform coitus is temporarily impotent. The one who wishes to be joyful, whether or no, becomes angry, etc. The greater the violence that consciousness attempts to exercise the greater is its defeat, while the same wished-for feelings develop spontaneously when, without concentration, we yield to the belief in them, especially with the aid of the corresponding conceptions of the imagination.

If an individual is extremely anxious to be hypnotized, and is at the same time, clear concerning its character and the results of suggestion, his consciousness cannot be deflected from the psychological process and he is hypnotizable with difficulty, or not at all, at least until he becomes psychically passive; and the more often and the more anxiously any one attempts to become passive, the less does he become so. Intense mental excitement, insanity, the firm resolve to resist the hypnotizer, are also conditions which make hypnosis impossible. Every mentally sound individual is hypnotizable. It is only certain temporary conditions of the mind which may prevent hypnosis.

It was often regarded as an axiom that one who did not desire to be hypnotized could not be so, at least not at the first trial. In my opinion too much importance should not be attached to this statement which depends more or less upon the psychological erroneous assumption of an essential freedom of the human will. Man must first be able not to will, in order actually not to will.

Suggestion acts most rapidly and certainly by surprising the imagination. As we have just seen, it is disturbed by long previous consideration. In a few seconds an easily suggestible individual who has never been hypnotized can be converted into the willing puppet of another individual, and I have observed that by a sort of contrast those individuals who mock at hypnotism and who declare ostentatiously that they cannot be hypnotized are often hypnotized most rapidly, if they do not offer direct resistance, and often even despite resistance. It seems as if the gauntlet thrown to hypnotism gives them an anxious notion of their own uncertainty, which delivers them up so much more surely to suggestion.

As a rule, uncultivated individuals are hypnotized with extreme ease by suggestion, without their noticing what is really done. They do and believe what is suggested to them, and sleep in one or two minutes before they are aware of it—often when only a moment before they had regarded other hypnotized persons as simulants and the physicians as dupes. The majority of the insane are undoubtedly hypnotized with the greatest difficulty.

It is also an important fact that, not infrequently, we can influence by suggestion a normally sleeping individual, and thus, without waking, lead him into hypnosis. To convert hypnosis into ordinary sleep is still easier.

Finally, there are very suggestible individuals who, in the complete waking condition, manifest all the phenomena of hypnosis without previous sleep, or yield thoroughly to the suggestions of an expert hypnotizer. In these cases there is no question of "I do not want to." This succeeds not infrequently even in an individual who has never been hypnotized heretofore.

As a general thing, the sleep produced by suggestion remains the chief measure for bringing the suggestion into complete action. It acts like a landslide after the first blow which it has delivered. The more it grows, the greater becomes its violence. Suggestion produces sleep or slumber; hardly is this present, when the suggestibility increases as the result of the sleep, and usually so much the more, the deeper the sleep becomes.

We said at the start that every individual is suggestible. If a man cannot be hypnotized, this can only be due to the fact that consciously or unconsciously he has made the auto-suggestion of non-hypnotizability. Prof. Bernheim has communicated to me in a letter the following case from his clinic, which he permits me to publish, and for which I express my thanks:

"A few days ago a peasant woman entered my service with pains in the stomach and abdomen which I regard as hysterical. I am unable to hypnotize her. She maintains, moreover, that Dr. Liébault vainly attempted to hypnotize her in her childhood. After two useless attempts, I say to her: 'It is immaterial whether you sleep or not; I will magnetize your abdomen, chest, and stomach, and thus relieve the pains.' I

close her eyes, and continue suggesting in this way for about ten minutes. The pain disappears without the sleep, but reappears after supper. On the following day I repeat the same procedure with the same result. The pain appears very slightly at night. To-day I begin again, and now, coincident with the disappearance of the pain I produce deep hypnotic sleep with amnesia." Dr. Bernheim adds: "Everything depends upon the suggestion. We must only find the spring in order to arouse each individual suggestibility into activity." This statement I can only confirm. On one occasion, Bernheim was unable to hypnotize an individual, and it appeared that this individual had been hypnotized by Beaunis, who had given him the suggestion that he alone could do it. I myself caused a lady to fall into a profound sleep with post-hypnotic suggestion, after Prof. Bernheim had only succeeded in producing somnolence—because she had formed the auto-suggestion that I alone could influence and cure her.

Sleep and Hypnosis.—The relationship of hypnosis to normal sleep is undeniable, and I agree with Liébault when he says that it is only distinguished as a matter of principle by the association of the sleeping individual with the hypnotizer. I may here be permitted to adduce a few of the principal facts.

It has always been said in physiology that sleep is produced by exhaustion; but this is not correct. Although real exhaustion of the brain usually produces the subjective sensation of being tired, we must, on the other hand, remember: 1, that severe exhaustion not infrequently causes sleeplessness; 2, that we often become still more desirous of sleep after sleeping; 3, that the tired feeling, drowsiness, and real exhaustion often occur independently of one another; 4, that drowsiness, as a rule, appears at a certain customary (auto-suggested) hour, and when it has been overcome, disappears despite increasing exhaustion.

These facts are entirely inexplicable by the very unsatisfactory chemical theories of the physiologists (lactic-acid theory of Preyer, etc.). The physiologists have attempted to measure the intensity of sleep by the intensity of the sounds necessary to cause waking. How little this proves is shown by the fact that an habitual sound soon ceases to awaken, even when it becomes very loud (for example, an alarm-clock), while slight

unusual sounds awaken at once. Many anxious mothers are awakened by the slightest noise on the part of the child, while they sleep through the snoring of their husbands or other accustomed noises.

Quiet, as well as tiresome, monotonous processes, which do not stimulate a change of conceptions, make us sleep; also a comfortable position of the body, and darkness. At the same time, associated phenomena set in, such as yawning, nodding, stretching of the limbs, which increase still further the subjective feeling of drowsiness, and, as is well known, are very infectious from man to man.

We have said that the habit of sleeping at a certain time daily produces pronounced drowsiness at that time. A certain locality, the voice of a certain individual, lying in a certain rocking chair in which we usually sleep, listening to a sermon, lying in a certain definite position of the body, etc., etc., but particularly closure of the lids, are very easy methods of producing sleep—and why? It has hitherto been called habit, or associated habit; but we must acknowledge that these facts are entirely co-ordinate with unconscious auto-suggestion. My two-year-old son had become accustomed to sleep with a handkerchief in his right hand applied to the face. When it was taken away, for a long time he could not fall asleep. In some individuals, indeed, certain actions must be performed before sleep will follow (reading, winding the clock, etc., etc.), but the most vigorous of all these associations is heaviness of the lids, their uncontrollable drooping; hence this is the best suggestion of sleep. If we observe sleeping individuals we soon notice that they move; that they react to sensory irritation; that they cover themselves when exposed; not infrequently speak, groan or stop snoring at command; even answer questions; occasionally rise and walk about. Certain individuals sleep very lightly and awake at the slightest noise. These show more communication with the external world. Subjectively we know our sleep only by the dreams. We feel that our dreaming consciousness is different from our waking consciousness, but approximate the latter so much the more, the lighter the sleep. This sleep consciousness is distinguished from waking consciousness particularly by the following facts: 1, there is no sharp distinction between conception and perception; all conceptions are more or less hallucinated, that is,

they have the subjective character of perceptions, and simulate real events. 2. While these sleep or dream hallucinations usually lack the clearness and precision of the waking perceptions produced by external processes, nevertheless, they are associated with very intense emotions and may exercise vigorous reaction upon the central nervous system. A dream may produce perspiration and spasmodic contractions of the muscles, intense anxiety, etc. Erotic dreams produce pollutions without the mechanical rubbing of the penis, a thing which erotic perceptions during waking are rarely able to do. 3. Dream hallucinations, in opposition to thought and perception while waking, are associated very imperfectly. They are connected usually by very loose external associations. Thought during sleep lacks the logic of waking thought, which, in the course of life has become organized unconsciously and instinctively in the gradually automatized psychical dynamism. The greatest nonsense is therefore dreamt, associated in the dream in time and space, and at the same time believed. Usually only in light sleep, rarely in a deep sleep, is there a more or less high degree of logical correction.

These three characteristic properties of dream life are at the same time the criteria of hypnotic consciousness; hallucinations of the conceptions, intense emotional action, dissociation of the organic logical associations. At the same time these are the best conditions for intense suggestibility.

Awakening, the reverse of falling asleep, shows entirely the same suggestive phenomena as falling asleep. A light sleep often forms a gradual transition to waking and leaves behind memories of dreams. Not infrequently dreams cause waking. It is a peculiar characteristic of many individuals to be able to awake at a certain desired time, and thus to measure time accurately during sleep. This is also found in hypnosis.

As in hypnosis, so in normal sleep, Liébault distinguishes a light sleep with memories of dreams, from deep sleep without such memory. A characteristic of the latter is total amnesia on waking. Nevertheless we find in individuals with profound sleep the phenomena of somnambulism, in which the sleeping individual walks and acts (often in a very irregular and complicated manner), speaks and even exercises violence—a phenomenon which has been recognized in the statute books as a cause of irresponsibility. This shows that the amnesia after

deep sleep is simple amnesia, and by no means proves that consciousness is lost in deep sleep, only that it is changed. In Wundt's "Philosophische Studien," Friederich Heerwagen, under the direction of Kraepelin, has published "Statistical Investigations concerning Dreams and Sleep" which are based upon the statements of many individuals. The statements of these individuals that they dream a good deal, or little, or not at all, are decisive, according to Heerwagen, and form a basis for his statistics. But inasmuch as the study of hypnotism and many experiences concerning normal sleep prove that no reliance can be placed upon these subjective memories or non-memories of dreams, because many individuals simply forget all their dreams and almost all forget the greater part of them (auto-suggestion of amnesia), I can attach no weight to these statistics, and, on the contrary, believe that all individuals dream constantly during sleep.

This brings us to the consideration of amnesia as one of the most important, indeed as, forensically, the most practically important phenomenon of sleep and hypnosis. As a rule, one who normally sleeps deeply is also a deep sleeper in hypnosis, and such a one is usually left to the mercy of the hypnotizer. In him we can produce at will remembrance and amnesia for this or that period of his life, or, at least, of his sleep. Bernheim produced deep sleep in more than half of his hospital patients. In order to show the enormous degree of profound hypnotizability among normal individuals, I will merely state that among the present twenty-six female nurses in the Burghoelzli Asylum I have attempted in twenty-three, and in all successfully, to produce hypnosis. In one I produced only somnolence; in three, light sleep without amnesia; in nineteen, deep sleep with amnesia, post-hypnotic phenomena, and a suggestive condition when awake. In two of them catalepsy and anaesthesia were at once produced in the waking condition by affirmation; neither had ever been previously hypnotized.

Degree of Hypnosis.—The celebrated Charcot's phases, lethargy, catalepsy, and somnambulism, undoubtedly depend upon self-deception. Bernheim has attempted a division into many grades, but there are no boundaries. I find that it is sufficient to assume three grades, which, however, exhibit transitions: 1. Somnolence, in which the slightly influenced indi-

vidual, by employing all his energy, can resist the suggestion, and open his eyes. 2. Light sleep or hypotaxia or charme. The influenced individual can no longer open his eyes and must submit to a part of the suggestions or to all, with the exception of amnesia. He does not become amnestic. 3. Deep sleep or somnambulism, characterized by amnesia after waking, and by post-hypnotic phenomena. According to my experience, post-hypnotic phenomena also occur not infrequently after light sleep. Under certain circumstances the suggestibility may be very slight, or even almost nil (very rare cases) during very deep sleep. We can, however, also produce sleep with open eyes, successful suggestion in the waking condition as well as the amnesia, and, on the other hand, can produce memory by suggestion, so that all these three grades are very imperfectly defined. The main feature depends upon what is suggested at the beginning. With practice or training, by means of suggestion we can also convert the somnolence into hypotaxia, and the latter into somnambulism, at least not infrequently, by suggestion of amnesia.

Training.—Much has been said of the training of the hypnotized. It is certain that frequent hypnosis increases the suggestibility of the individual, and especially may cause him to do without verbal command everything that he had done in the first hypnosis, apparently instinctively. As Bernheim so truly says, the somnambulist appears to concentrate his entire attention upon divining the wishes of the hypnotizer. In recent times, however, particularly in Germany, the part played by training has been very much overestimated, and the extent of the individual suggestibility of the majority of normal individuals has not been recognized. Where is the training, for example, when I yesterday hypnotized for the first time a perfectly normal female nurse; I look at her for a few seconds, suggest sleep, then let her look at the two fingers of my left hand (according to Bernheim's method). At the end of thirty seconds her lids fall; I suggest amnesia; catalepsy of the arms; turn the latter and suggest anæsthesia. Everything succeeds at once. I prick deeply with a needle; she feels nothing. I administer water as a bitter mixture, which tastes bitter; then successfully suggest appetite, and tell her that after awaking she will, of her own volition, place a paper basket standing under the table upon the lap of one

of the individuals present, and that at six o'clock at night she will again voluntarily come to me. I then awaken her by allowing her to count up to four. She remembers absolutely nothing of what has happened, but looks steadily at the paper basket, which she places, shamefacedly and blushing, upon the lap of the individual in question. She is angry at this action, to which she has been driven uncontrollably without understanding why. At six o'clock she is alone in the ward, and therefore cannot leave, but feels the desire to visit me, becomes very excited and anxious because she cannot yield to this desire. Who can call this training? The young peasant girl only entered here recently and was hypnotized for the first time, and yet she acted almost exactly the same as a somnambulist who had often been hypnotized.

Phenomena of Hypnosis.—It may be said that by suggestion during hypnosis we can produce, influence, prevent (inhibit, modify, paralyze or stimulate) all the known subjective phenomena of the human soul, and a large part of the objectively known functions of the nervous system. The purely ganglionic functions and spinal reflexes, as well as the equivalent reflexes of the base of the brain alone appear to be uninfluenced by suggestion. Yes, even more. Suggestion may influence certain so-called somatic functions, such as menstruation, digestion, even the formation of epidermic vesicles, so that in this manner the dependence of these functions upon the dynamism of the cerebrum is most clearly proven. We do not mean to imply that these results can be effected with every hypnotized individual, but with patience the greater part can be produced in profound sleep.

These phenomena are produced by the simple affirmation that they are present, at best by touching the part of the body where they are to be felt subjectively and by describing (in a loud, convincing voice) the process of their development. We begin by placing the one to be hypnotized comfortably in a chair, looking at him, and assuring him that his lids are growing as heavy as lead, that they close, etc.; in short, by suggesting the phenomena of falling asleep. Illustrations:

Motor Phenomena.—Raising the arm, I say that it is stiff and cannot be moved. The arm remains in cataleptic rigidity (suggestive catalepsy). The same thing succeeds for every conceivable position of the muscles of any part of the body.

I say, the arm is paralyzed, and it falls like a mass of lead. This happens at once, and the hypnotized individual can no longer move it. I explain to the patient that he can speak and answer me. He begins to answer questions. In like manner he can walk, act, command, suffer from spasms, mumble, etc. I tell him he is drunk and totters; at once he walks like a drunken man.

Sensory Phenomena.—I say: "A flea is upon your right cheek; it itches." At once a grimace follows, and the hypnotized scratches himself upon the described spot. "You feel an agreeable warmth in the legs and arms." At once he affirms it. "You see before you a vicious dog; he barks at you." The patient jumps back in fear and drives away the supposed dog, whom he sees at once and hears. I place air in his hand with the assurance that it is a bouquet of violets. With joy he breathes in the aroma of the violets that are not present. From one and the same glass of water I can in a few seconds and sips make the hypnotized drink bitter quinine, salt water, raspberry juice, chocolate, and wine. Nor does he require either a glass or water. The statement that he has a glass of the corresponding drink in his hand suffices. Pain can be easily suggested, and when present, it can, above all, be suggested away. For example, headache can be relieved with ease in a few seconds, at the most, minutes.

Anæsthesia, amnesia, blindness, color blindness, double vision, deafness, inability to taste, may be easily suggested. I have had teeth extracted during hypnosis, abscesses opened, corns extirpated and deep incisions made, without sensation on the part of the hypnotized. The assurance that the affected part of the body is dead and insensible is sufficient. Surgical operations, even parturition, are possible during hypnosis, which then advantageously and without any danger supplants chloroform narcosis.

Bernheim properly applies the term negative hallucination to the remarkable deceptive perception of the disappearance of a present object. To a hypnotized individual who sleeps with open eyes I say that I disappear, and he no longer sees, hears, or feels me. He spontaneously supplements the hiatus in the visual field by positive hallucinations concerning objects. At my suggestion he can also hear and feel me without seeing me, etc.

Reflexes.—I say “You must yawn.” The hypnotized yawns. “Your nose itches, and you must sneeze three times in succession.” He at once sneezes three times in a natural manner. Vomiting, diarrhœa, constipation, etc., may be produced in the same way.

Vaso-motor effects are among the most wonderful phenomena. We can produce or discontinue the menstruation of women by simple prophecy during hypnosis; can regulate its duration and intensity. In two individuals I have effected the accuracy of their obedience to the very minute indicated, both as regards the beginning as well as the end of menstruation. Blushing and pallor may be produced; also redness of definite parts of the body or parts of the skin; epistaxis, even vesication and bleeding stigmata. These, however, are rare results. Furthermore, the pulse and respiration may be accelerated or slowed.

Feelings—Emotional Effects.—Appetite is easily suggested by affirmation. The effect of the suggestion may be increased by touching the stomach, or by permitting the ingestion of suggested food. Anxiety, joy, hate, anger, jealousy, love of any one or anything, etc., are easily produced by suggestion; also laughing and crying. Onanism, nocturnal enuresis were often cured in a similar manner.

Mental processes, memory, consciousness, will, are influenced in the same way. I say: “Everything that I have told you in your sleep will be forgotten by you, and you will only remember that you had a cat upon your lap and stroked it.” After awaking the hypnotized has forgotten everything with the exception of the cat episode. To a young lady who spoke French well, my colleague Frank said: “You no longer know a single word of French until I restore it to you,” and the poor girl could not speak French until the suggestion had been removed. This individual could be made temporarily mute and deprived of all her psychical faculties by simple suggestion. Since then, similar experiments have often succeeded in my hands. To a somnambulist I allowed long dead relatives to appear post-hypnotically, and with these she conversed for a long time. Others I allowed, like Peter, to walk upon the sea or upon a river. Others I transformed into hungry wolves or lions, so that they attacked me barking and wanting to bite me. One man I converted into a girl who

remembered her menstruation. On the other hand, I converted a girl into an officer. By the suggestion of childhood in good somnambulists speech and writing are changed in a corresponding manner. Such things often leave behind a profound emotional impression unless amnesia is suggested.

I may convey to the hypnotized any desired thought or notion. I may convey to him any conviction; for example, that he no longer desires wine; that he shall join this or that society; that he wants this or that which he formerly could not tolerate. In an alcoholic subject who had become false to her vows of abstinence I produced by suggestion, and without saying a word to her in her waking condition, pangs of conscience and remorse, open (spontaneous) confession to the president of the temperance society, and renewal of her pledge of abstinence. The success was very striking and followed immediately upon a single hypnosis, while nothing of the sort had been previously observed. The action upon the will is especially important and the volitions of the hypnotized may be influenced at pleasure. It has often been maintained that the latter thereby grows weak and infirm in will. This is a mistake which is due in part to the false assumption of an essentially free human will. Indeed, a weak will can often be strengthened by hypnosis.

Resistance of the Hypnotized—Auto-Suggestion.—Like Liébault, Bernheim, and others, I have produced all of the above-mentioned phenomena and many others in my hypnotized individuals, but, as Bernheim justly emphasizes, we should not be blinded by the power of these almost terrifying facts, and therefore overlook the other side of the phenomenon, namely, the resistance of the cerebral activity of the hypnotized to these foreign attacks. The blind, automatic obedience or belief of the hypnotized is never complete. The suggestion always has its limits, which are sometimes broader, sometimes narrower, and may also vary greatly in the same individual.

The hypnotized resists in two ways: consciously, by his rational logic; unconsciously by auto-suggestions. I lift the arm of the hypnotized and say it is stiff. He attempts with spasmodic rage to bring it down, and finally succeeds, but the feeling of strain which he experiences brings him so much more certainly into my power, because it shows him my predominance. I say a second time: "I draw your arm forcibly

upward by magnetism." This suffices to prevent its falling. I keep my hand in front of his, and without touching it force him, by the power of his suggestibility, to lift it over his head.

But the resistance was there. If it is not overcome very rapidly, the hypnotized believes in his power of resistance and overcomes a number of suggestions. Indeed, some lose their suggestibility by vigorous reflections of reason and strength of will. This results more often from the fact that they are dissuaded by other individuals. As a rule, the hypnotizer retains what he has already gained, but if, in an unskilful manner, he has several times failed in a number of suggestions he can with difficulty regain them, inasmuch as the auto-suggestion that this or that cannot be effected is formed in the hypnotized. For example, I say to a hypnotized while touching his hand, that I make it dead and insensible; but he still feels and does not believe me, and when I ask, "Have you felt anything?" answers in the affirmative. In such cases it will be difficult to produce gradual anæsthesia. This is probably due in part to the insufficient profundity of the sleep, but by no means always. I have produced total anæsthesia in simple hypotaxia in the following manner: I did not touch the fingers whose anæsthesia I had uselessly suggested, and allowed the hypnotized to believe that I had touched them but that he had not felt it. Then, in the next following hypnosis I succeeded by very slight touches in gradually producing a partial anæsthesia. The same thing holds good with regard to amnesia. If amnesia cannot be produced after two or three sittings it will prove extremely difficult. Finally, however, it sometimes succeeds through certain manipulations. For example, we give to the individual a sip of water with the statement that it is a sleeping potion which will make him amnesic, etc. In short, as Bernheim says, the hypnotized is not a complete automaton. He often discusses the suggestions, especially in the beginning, and discards some of them. I might say that the chief factor consists in communicating to the suggestion the suggestive character of a dream or something past, of a perception or action before the hypnotized becomes conscious of it. If he first becomes conscious of it as a simple conception it succeeds with much more difficulty or not at all.

Typical auto-suggestions are the product of the brain itself

and abound in hysterical, but also in healthy individuals. For example, an otherwise healthy woman was sleepless, but had a good appetite. I hypnotized her and successfully put her to sleep. In its stead the appetite has now disappeared. The loss of appetite depends upon auto-suggestion. This illustration suffices to characterize the entire series of phenomena. For example, every night when we fall asleep in the accustomed position after we have retired to bed, this happens from auto-suggestion.

A cultured and very intelligent lady, Miss X., had seen me hypnotize and had been very much interested thereby. The power of her imagination and her understanding of hypnosis are illustrated by the following: During the next night she was awakened by a violent toothache. She now attempted to suggest this away herself by imitating aloud my voice and the monotonous tone and contents of my suggestion. She succeeded completely in driving away the toothache and falling asleep. In the morning on waking it had remained away.

This lady then told me the means employed by her lady friends to delay menstruation at pleasure, if it threatened to appear on the evening of a ball. They simply placed a somewhat narrow red thread around the little finger of the left hand. This measure did not act with equal certainty in all persons, but in some who had menstruated with extreme punctuality it acted with absolute certainty and could delay the menstruation even for three days. This woman is entirely trustworthy and the case is a striking illustration of unconscious suggestion, as became evident to her after she had seen me operate. In the mildest form of hypnotic influence, in the somnolence of Liébault and Bernheim, the hypnotized can resist with some exertion every suggestion, and only becomes somewhat suggestible when he allows himself to be passive.

Post-Hypnotic Phenomena.—Among the most important phenomena of hypnotism, especially from a forensic point of view, are the post-hypnotic effects of suggestion. Everything that is produced during hypnosis can often be produced in the waking condition by giving the suggestion to the hypnotized during hypnosis that it will happen after his awaking. Not all hypnotized are suggestible post-hypnotic, but with some practice and repetition we can produce post-hypnotic effects

in almost all profound sleepers, and even in many cases of simple hypotaxia without amnesia.

Illustrations.—I say to a hypnotized: “After waking you will have the idea of placing this chair upon a table, and then clap me upon the left shoulder with your right hand.” I then make other remarks, and finally say: “Count up to six, and you will awake.” He counts, and when he reaches six opens his eyes. He looks around for a moment as if drowsy, sees the chair, and stares fixedly at it. A battle often develops between reason and the powerful impulse of the suggestion; according to the degree of unnaturalness or naturalness of the suggestion on the one hand, and of the suggestibility of the hypnotized on the other, the former or the latter gain the victory. But, like other experimenters, I have repeatedly observed that when the suggestibility is marked, the attempt to resist the impulse of suggestion may have evil consequences. The hypnotized becomes anxious, excited, and annoyed by the thought that he must do it nevertheless. In two cases, indeed, a hypnotized individual was about to take subsequently a walk of three quarters of an hour, at one time, in order to clap me on the shoulder, and at another time, to hand Miss Y. a handkerchief. This desire may continue for hours and days; at other times it is feeble, may even be a mere thought like the memory of a dream but which does not lead to a conclusion, so that the suggestion is not carried out. The hypnotized merely looks at the object, or does not even look it. In such cases, however, by vigorous repetition of the suggestions during hypnosis the desire, and finally its execution, may be produced. Our hypnotized has now gazed at the chair. Suddenly he arises, takes the chair and places it on the table. I say: “Why did you do this?” The answer varies according to his culture and temperament, and the quality of the hypnosis. One says frankly: “I felt the desire. I was compelled to. I do not know why.” The other says, “The idea just came to me.” Another advances an *a posteriori* motive. “The chair was in his way, annoyed him” (or, after the suggestion that he would obtain a handkerchief and wipe his face with it, said “that he perspired so freely”). The fourth, after performing the action, has lost all memory of it; believes that he has just awakened. It is particularly in the latter event that the hypnotized has the appearance of a somnambulist. His gaze

is more or less fixed. His movements have an automatic character which is lost after the completion of the act. If the experiment is made for the first time upon one who knows nothing of hypnotism, and who is really entirely amnesic concerning the period of hypnosis, in my experience he will never suspect that the hypnotizer is the producer of his actions. Many suspect it either because they retain a dreamlike memory of the suggestion in hypnosis or because the experiment has already been made upon them, or because they had seen or heard or read of it in others.

I say further to a hypnotized: "After awaking you will see me dressed in scarlet red and provided with two goat's horns upon my head. At the same time my wife sitting next to me will have disappeared, and also the doors of the room, which will be entirely replaced by carpets and portières, so that you will be forced to go through the other doors." I now speak of other matters, allow the hypnotized to yawn three times by suggestion, and thereupon to awaken. He opens his eyes, rubs them several times, as if he wished to remove a cloud, looks at me, begins to laugh and again rubs his eyes. "Why do you laugh?" "You are all red and have two goat's horns upon your head. Your wife is gone." "Where did she sit?" "Upon this chair." "Do you see the chair?" "Yes." I ask him to touch the chair. He does not do it willingly; feels around my wife; thinks that he sometimes feels the chair, sometimes an invisible resistance (according to the manner in which he has supplemented the suggestion by auto-suggestion). Then he wants to leave, but is unable to; sees only the carpets and portières, and also maintains this after touching the doors. When I now open the doors the hallucination may disappear or continue. In the latter event he sees the empty space filled by carpets and portières, but does not see the open doors. According to the suggestion and the individual these post-hypnotic hallucinations may continue from a few seconds to hours, or even days. As a general thing they only last a few minutes. I have attempted to make the hypnotized trace pictures, which I had suggested, upon white paper. The drawings, as a rule, were poor; the individual stated that they saw the pictures indistinctly. A few were not poor. Bernheim relates that a lady was unable to say whether a rose suggested in this manner was real or suggested. I have often

made the following experiment: I told Miss Z., during hypnosis, that after awaking she would find two violets upon her lap, both natural and beautiful; she would give me the more beautiful one. I, however, placed a real violet upon her lap. After awaking she saw two violets; the one was brighter and more beautiful, she said, and gave me the corner of her white handkerchief, retaining the real violet for herself. I now asked whether she thought that both violets were real, or whether one was one of my temporary gifts which she knew from previous experience. She said that the brighter violet was not real because it looked so flat upon the handkerchief. I repeated the experiment with the suggestion of three real equally dark, by no means flattened violets, and provided with palpable stem and leaves, but gave her only one real violet. This time Miss Z. was entirely deceived and was unable to say whether one of the violets, or two, or even all three, were real or suggested. She thought that this time all three were real, holding in the one hand air, in the other, the real violet. If the deception is suggested for all the senses, it becomes more complete. For example, I give another hypnotized individual a real knife and tell her there are three of them. She is perfectly awake and cannot distinguish the supposed three knives from one another, neither in cutting nor on feeling them, nor tapping upon the window with them, etc. When other persons afterward laughed at her, she became angry and firmly maintained that there had been three knives, but that I had abstracted two. She had seen, felt, and heard all three knives and could not be convinced to the contrary.

Feelings, thoughts, convictions, etc., may be suggested post-hypnotically as well as hypnotically. The results obtained in the above-mentioned inebriate and in the menstruation of women were post-hypnotic. In only two cases did I succeed in producing or checking menstruation at once during the hypnosis.

Amnesia or Loss of Memory.—We must here warn against the old mistake of confounding this notion with that of unconsciousness. That we no longer know anything concerning a definite period of our life, or certain events through which we have passed, by no means proves that we were unconscious at the time, even if the amnesia at once follows this period. Yet, as a general thing, we have no other proof but this very am-

nesia that an individual was unconscious. This is almost tantamount to the declaration that it is impossible to demonstrate unconsciousness. We can only speak of a probable obscuration of consciousness. As a general thing, though not always, an individual is amnesic concerning the period of profound obscuration of consciousness. On the other hand, by suggestion we can at will make the individual amnesic concerning facts and periods of life in which he had been perfectly conscious. Amnesia of a certain period, therefore, does not entail absolute unaccountability during this period.

Amnesia plays a very important part in hypnosis. I will illustrate its significance by a single illustration: In a man suffering from toothache I attempted to produce anæsthesia by suggestion. This only succeeded partially, but the extraction of the tooth was nevertheless performed. He awoke at the time, cried out, grasped the hand of the physician, and struggled. I continued to suggest, as the tooth was removed, that he was sleeping very well; that he felt nothing at all; that on waking he would have forgotten everything, and that he had no pain. He then slept and on waking was amnesic concerning everything. He therefore imagined that he had felt nothing and was very glad and thankful for the painless extraction of the tooth. At a later period I had him questioned concerning this by a third person from whom he had absolutely no reason for concealing the truth. He said, however, that he felt nothing at all. On the other hand, I have had teeth extracted in waking individuals who had been made anæsthetic by suggestion. During the extraction these individuals, who otherwise dreaded pain extremely, laughed and experienced not the slightest sensation. In the former case we had merely inhibited by suggestion the consciousness of the memory image; in the second event, we had inhibited the consciousness of the peripheral irritation itself.

Suggestion à Échéance (Suggestion for a Definite Period).—This phenomenon, so ably described by the Nancy school, is only a variety, but a practically very important variety, of post-hypnotic suggestion. I say to a hypnotized: "Tomorrow at 12 o'clock while you are on your way to your dinner the thought will suddenly occur to you that you must write me at once how you are feeling. You will return to your room and write; will then suffer from cold feet and put

on your slippers." After awaking, and until the following day at 12 o'clock, the individual has no suspicion of the entire matter. At the moment he is going to dinner the suggested thought rises in his consciousness and is punctually carried out. To another I say, on Monday: "Next Sunday morning, at 7:15 o'clock sharp, your menstruation will begin. You will at once go to the supervising nurse, tell her the fact, and then come to me and report. You will see me in a sky-blue coat and with two long horns upon my head, and will then ask when I was born." On the following Sunday I was seated in my study and had entirely forgotten the matter. The hypnotized individual knocks at my door at 7:35, enters, and almost bursts with laughter. I at once remembered my suggestion, which was now carried out word for word. The menses had appeared punctually at 7:15 o'clock. This had been reported to the supervising nurse, etc. In the waking condition the individual had previously had no suspicion of the entire matter, not even of the period at which the menstruation was to occur. The enormous importance of suggestion à échéance is evident. We can determine the thoughts and resolutions of the hypnotized for a certain period in advance, when the hypnotizer is no longer present. In addition, we can supply the suggestion of a free effort of the will. We may also suggest that the hypnotized will have no suspicion that the desire is due to the hypnotizer. Indeed, in very suggestible individuals we may even successfully suggest total amnesia of the hypnotization: "You have never been hypnotized; if you are asked, you will swear that no one has ever put you to sleep. I have never put you to sleep." It is very evident to me that herein lies the most dreaded forensic danger of hypnosis. Of the above-mentioned nineteen healthy nurses who sleep soundly during hypnosis, no less than thirteen carried out suggestions à échéance. Hence the symptom is by no means rare. In one nurse, as already mentioned, it succeeded even at the first hypnosis.

The opinions of the hypnotized concerning the source of the successful suggestion à échéance are extremely remarkable. When asked how they happened to do so and so, they usually state that it was an idea which occurred to them at the suggested time and which they were compelled to execute. They constantly give the time at which the idea occurred to

them, while, as a general thing, one does not look at the clock with every passing thought; hence this is to be regarded as a co-effect of suggestion. Because the period of time has been suggested, they pay attention to it. Furthermore, the suggested idea develops suddenly at the suggested time, at least usually. In a few cases, however, it appears for quite a time before. It seems to the hypnotized "as if in a time to come he must think or do this or that." In rare cases the idea does not develop with the subjective character of spontaneity, but as a suddenly appearing memory of the hypnosis. Then the hypnotized individual says, for example, "Suddenly, at 12 o'clock, I remembered that you told me yesterday during the sleep, that I should come to you at 12 o'clock to-day." As a general thing, the suggestion of a definite period possesses the character of a force, an irresistible desire, until it is completed. The intensity of the desire, however, varies greatly. Practised somnambulists generally recognize by these qualities that they have to deal with suggestions and not with their own idea or volition; but it is usually not difficult to deceive them, if we in advance suggest away the character of unnatural force, and replace this by a free, spontaneous volition, skillfully and logically associating the suggested thought with actual occurrences. In this way it is not difficult to deceive the somnambulist so that he remains perfectly convinced that he has acted spontaneously and with uninfluenced will.

It is a most astonishing fact that the contents of the suggestion rarely become conscious in their waking condition during the period from hypnosis to the period suggested. But if, on the other hand, the individual is hypnotized during this interval and he is asked during the hypnosis what he must do at such and such a time as a rule he knows it accurately. Bernheim therefore concludes, in my opinion without justification, that the hypnotized individual thinks of the matter during the entire period, but is not conscious of it. I do not believe that we may express ourselves in such a manner because it disturbs our psychological conceptions. We have to deal with unconscious thinking or knowing, with a cerebral dynamism which slumbers below the level of consciousness and which is repeated by means of a sign of time that is associated with it and with the suggested period. In this way alone can we explain the suggestions à échéance

which Liébault, Bernheim, and Liégeois successfully carried out even at the end of a year. In suggestions at a brief period, the feeling of time without a sign of time may suffice to produce the suggestion at the correct period. The phenomena of suggestions à échéance are identical with those of other post-hypnotic suggestions.

Waking Suggestions.—In very suggestible individuals in the full waking state we can employ suggestion successfully, without producing hypnotic sleep, and can thus produce all the symptoms of hypnosis or of post-hypnotic suggestion. We lift the arm and say: "You can no longer move it," and the arm remains in cataleptic rigidity. We may suggest anaesthesia, hallucinations (also negative ones), amnesia, mutism, hallucinations of memory, in short, whatever we wish in this way, with as certain results as in hypnosis. And the waking suggestion can be effected not alone in hysterical individuals, but also in perfectly healthy ones.

As a general thing, waking suggestibility can be effected only in individuals who have been placed in hypnotic sleep one or more times. Yet pronounced suggestive effects may be produced in waking individuals who have never been hypnotized. In a very intelligent lady of my acquaintance, of firm character, the arm was fixed in a cataleptic condition by the suggestion of the magnetizer while she was completely awake; she had never known anything concerning hypnosis. I succeeded in two out of four non-hysterical women in whom I made the experiment.

By suggesting waking suggestibility during hypnotic sleep we can also produce the waking suggestibility in those cases in which previously it has not appeared to be present. It is then suggested spontaneously. I am firmly convinced that only the necessary practice and boldness are requisite in order to produce waking suggestibility in a large percentage of normal individuals, inasmuch as I have succeeded in all of the above-mentioned nineteen deep-sleeping nurses.

Condition of the Mind during the Performance of Post-Hypnotic Suggestions, Suggestions à Échéance and Waking Suggestions.—Whoever has often observed all of these phenomena will soon be convinced that the condition of the mind of the hypnotized in the three cases just mentioned must be and is the same; the soul is awake and yet changed. How

changed? Liégeois ("De la suggestion hypnotique dans ses rapports avec la droit civil et le droit criminel," Paris, 1884), Beaunis ("Recherches expérimentelles sur les conditions de l'activité cérébrale," etc., "Somnambulisme provoqué," p. 67), and then Delbœuf ("Revue de l'hypnotisme," 1ère année, 1887, p. 166), were the first to attempt to answer these questions. Liégeois applies the term "Condition Prime" to this condition, in which the hypnotized individual is perfectly awake and normal with the exception of that point which the hypnotizer has prohibited or commanded. This condition is the analogue of the "Condition Seconde" which Azam applied to the second condition of consciousness of his Felida (case of double consciousness in the waking condition). Subsequently, however, Liégeois came to the conclusion that the "Condition prime" is only a variety of the "condition seconde." Beaunis calls the "condition prime" "veille somnambulique." Delbœuf, on the other hand, thinks that he has proven that in all of these cases the hypnotized individual is simply re-hypnotized, and that we have to deal, therefore, with ordinary somnambulism, except that it occurs with open eyes. The suggestion simply produces unconsciously a new hypnosis by association. [After I had finished this work I found an article by Delbœuf in the "Rev. de l'hypnot." (April 1st, 1888) in which he expresses a different opinion concerning the phenomena in question and concedes the gradual transition of the waking condition through suggestive conditions while waking into hypnosis proper. As I arrived at the above-mentioned conviction independently of him, I leave the text unchanged.]

In my opinion none of these views hold good, because all are too dogmatic. Delbœuf is undoubtedly right with regard to many cases. In post-hypnotic suggestions, suggestions à échéance, and in the waking condition, the actual occurrence of the suggested phenomenon may produce the auto-suggestion of hypnosis; the gaze becomes fixed and the hypnotized subsequently may be amnesic concerning everything. But if we attempt to generalize these cases we deceive ourselves as much as if we were to generalize the undoubted cases in which the suggestion is effected in a perfectly clear waking condition. We can eliminate by means of suggestion, everything hypnotic from these conditions, until they grow constantly more identical with the complete waking condition. There are all

stages, from the fixed to the perfectly clear gaze; from the uncritical automatism, in which the grossest nonsense appears as natural and self-evident as in a dream, to the finest and most severe self-criticism of the hypnotized individual and the most furious struggle against the force of the suggestion. Indeed, we may restrict the suggestion to such natural and trifling details, which we weave repeatedly into the chain of thought, that there can no longer be even a question of a "condition prime" in Liégeois' sense. Apart from the individual variations I have observed that the conditions under discussion approximate hypnosis so much the more when we suggest a more coherent, and at the same time, fantastic complex; but that, on the other hand, we approximate the normal waking condition when the suggestion is more natural, probable, restricted, and briefer. The subject will be explained most clearly by illustrations.

Lifting the arm of a woman who is thoroughly awake, I tell her she can no longer move it. She is astonished, attempts without success to lower the arm, is abashed, etc. I then add the following suggestions in rapid succession: "Here comes a lion; do you see him? He will eat us. Now he goes away. It is growing dark. The moon shines. Look at the large river there with the thousands of fish. Their bodies are stiff and they are unable to move, etc." In a few seconds all these impressions course through the consciousness of the woman as sensual perceptions with the corresponding feelings, and the condition of her mind approximates more and more to ordinary hypnosis. Things appear to her as if in a dream.

On the other hand, I say to the same hypnotized nurse: "Every time when the assistant physician passes through the ward and you report to him the condition of the excited patient, Louise C., you will make a mistake and call her Caroline C. You will notice it, attempt to correct yourself, but will be unable to do so, and will always say Caroline instead of Louise. Every time that you wish to address the assistant physician by calling him Doctor, you will at the same time, without noticing it, scratch the right side of your forehead with your right hand." The suggestion is carried out. In the middle of ordinary conversation the nurse constantly makes a slip of the tongue and says Caroline instead of Louise C. It is like the suggested paraphasia of a word. She notices it,

attempts to correct herself, but again makes the same mistake and is astonished thereat. Almost every time that she addresses the assistant physician by name she scratches herself as was suggested to her. It is astonishing to see how the unsuspecting nurse almost daily wonders at her mistake in pronouncing C.'s name, excuses herself, and says she cannot understand what is the matter that she always makes a mistake in this name; that such a thing had never happened to her before. At the same time, the scratching occurs instinctively with out her noticing it. Now, at the end of several weeks, she begins gradually to help herself, as she leaves the surname off, and says only "C." A single suggestion sufficed for this disturbance which occurred during such a long period. It would here be necessary to assume that the "condition prime" continued only during the articulation of the surname and during the scratching, while the remainder of the conversation occurred in the normal waking condition; but while she is scratching she says things that were not suggested to her and are thoroughly rational. Hence the "condition prime" exists only for a part of her mental activity.

To a cultivated young man (a student) I gave the suggestion during hypnosis that after awaking he would tap my right shoulder with his left hand. He resisted the desire, because he is very obstinate and was unwilling to yield an iota of the freedom of his will at any price. He went home. I had asked him to return at the end of a week, and on his return he confessed to me that my suggestion had bothered him for a week, so that several times he was on the point of coming to me (a distance of three-quarters of a mile) in order to tap me on the shoulder. Was a "condition prime" present during this whole week in which the individual worked as usual, heard lectures, slept, etc.?

In an intelligent, very suggestible nurse, the suggestions à échéance acted so powerfully that she complained to me she was absolutely overcome and would be compelled even to commit murder should I suggest it to her, so fearful was the desire to carry out even the grossest nonsense. Her repeated vigorous attempts at resistance only increased the desire so much more violently. At one time she spoke to me in the presence of two persons concerning hypnotism, and said: "But, Mr. Superintendent, although I must do everything

that you suggest to me during sleep, yet I know that it comes from you, although I knew nothing of it beforehand; it is a very peculiar desire and has a strange character." I said to her: "Fall asleep." She slept at once. I then said: "Half a minute after waking the idea will occur to you spontaneously to ask me the following question: Ah, Mr. Superintendent, I have often wanted to ask you how it comes that we fall asleep so suddenly in hypnosis. In ordinary sleep this is not so. We fall asleep more slowly. How does this come; it is so very astonishing. You will then have no suspicion that I told you this during the sleep; will think that the idea comes entirely from you, and that you long wanted to ask me. Now, count to six, and you will be awake." She counts, awakens, and assures me that she has slept very well. Then, at the end of about half a minute, she blurts out the suggested phrase, word for word, her questioning tone expressing the greatest interest. I listen quietly, answer her, and then ask how she happened to ask me this question. "Well, I wanted to ask you that for a long time." "Is it not a suggestion which I just gave you during sleep?" "By no means; I cannot be mistaken; this is my own idea." "And yet you are mistaken; here are two witnesses who have heard me suggest this to you word for word two minutes ago." The poor hypnotized woman was greatly confounded and was compelled to acknowledge that not every suggestion could be recognized by her as such, but only those which were sufficiently grotesque not to be the product of her own brain.

I could adduce many other illustrations, because I have devoted special attention to this part of the subject. The above mentioned post-hypnotic hallucination of a woman who could not distinguish two suggested violets from a real one, belongs, for example, to this category. But it will suffice to show that a suggestion can be smuggled into the normal activity of the waking normal mind in such a way that every hypnosis-like phenomenon is excluded. In these cases the hypnotized individual is completely deceived; believes that he thinks or wills spontaneously, and does not suspect the will of the hypnotizer.

Spinoza's dictum that the illusion of a free will is nothing more than the ignorance of the motive of our volitions, has never been proven more conclusively than by this hypnotic

experiment. It is a perfect ocular demonstration that our subjective free will is conditioned objectively. The only difference is that in the hypnotized it is influenced by the suggestions of another and in the non-hypnotized by auto-suggestions.

The interesting and frequent transition form between hypnosis and the waking condition consists in the fact that the hypnotized, while his eyes are open and he acts like a normal individual and forgets nothing, has a slightly fixed gaze, finds unnatural and nonsensical suggestions natural, that is, he is not astonished at them and carries them out without discussion. If he is questioned afterward, he not infrequently states that he felt somewhat dizzy or as if in a dream; he was not thoroughly awake and clear in his mind.

Permanent Results of Suggestion.—Can we change permanently by suggestion the soul or any nervous function, even in a single special point? This question has often been put, but has hardly been answered satisfactorily. Suggestions à échéance have been given for the duration of a year. Sleep lasting days has been produced by suggestion and particularly a series of permanent therapeutic results have been brought about. On the other side, however, every one who concerns himself with hypnosis must admit that with time the action of an hypnosis is enfeebled and that the hypnotized individual, after the prolonged absence of the hypnotizer, gradually ceases to remain under his influence.

The therapeutic results of hypnosis, carefully considered, appear to me to give the best explanation of this apparent contradiction. I believe that a permanent result can be effected only: 1, either when the desired change itself contains the power to be converted into auto-suggestion or habit by a single or repeated suggestion, and to maintain itself in the struggle for life between the individual dynamisms of the central nervous system; 2, or when this power which it lacks is secured by auxiliary remedies which, it is true, can be secured in great part by suggestion. We must then always furnish the suggestion that the result will be permanent, but as a matter of experience this rarely takes place completely.

Illustrations.—1. A child has retained the bad habit of wetting the bed. By suggestion he is forced to arise at night and to urinate into the vessel, finally, even to retain the urine. The bad habit was replaced by a good one which at

the same time acts normally and easily becomes fixed. The child had accustomed himself to sleep in the wet. Now he becomes accustomed to remain dry. Even the dream of wetting will awake him. Here we can produce permanent recovery. 2. Some one suffers from migraine, insomnia, anorexia, a tired feeling, and, as a result, has become anæmic and emaciated. I succeed in securing sleep and appetite by suggestion. Hence the anæmia soon disappears; the hypnotized individual improves in nutrition and bodily weight. The sleep cures the nervous exhaustion, and thus the migraine (which can also be suggested away directly for the moment). Thus the equilibrium of the organism is restored and recovery becomes permanent when the cause which has produced the disease does not return or is not a permanent one.

For this reason I believe that suggestion is able not infrequently to remove acquired vices and bad habits; also certain acquired diseases, especially by the aid of auxiliary remedies, but that it will never change permanently hereditary or constitutional peculiarities of character. In such cases it will only have a temporary effect, as so often happens in severe and especially in deeply rooted maladies.

Every prolonged result of a suggestion, when it refers to acts in the waking condition, is *eo ipso* post-hypnotic. It thus belongs logically to Liégeois' "condition prime," for example, suggested menstruation, suggested cheerfulness, suggested disappearance of home-sickness, etc. If we carry this out to its logical conclusion, an individual permanently cured by suggestion would remain for his lifetime in the "condition prime." By this statement I only wish to show distinctly that there is no boundary between the changed condition of the mind in hypnosis and its perfectly normal activity in the waking state. All shades and transitions can be produced experimentally. Even without suggestion, in some individuals quite delicate transitions can be observed between spontaneous sleep and the waking condition. These are produced by the accident of auto-suggestion and therefore are by no means so finely shaded and not so systematically graded as can be effected by suggestion.

Retroactive Hallucination or Suggested Deception of Memory.—Bernheim applies the term retroactive hallucination to the suggested remembrance of things that have never

been experienced. I do not consider this expression appropriate because we do not have to deal with an effective actual perception and not necessarily with the memory of perceptions (it may also be the memory of a thought, a feeling, an act). Nor is it exactly the same as the phenomenon termed deception of memory in psycho-pathology, because this is always the projection into the past of an actual complex of perceptions. In my opinion, however, the suggested process is psychologically co-ordinate with the deception of memory. The notion is merely somewhat enlarged.

Illustration.—I suddenly say to Miss X. (she was awake), at the moment that an entirely unknown young man enters the room: "You are acquainted with this gentleman. A month ago at the railroad depot he stole your purse and ran away with it, etc." She looked at him at first with astonishment, but was at once convinced, remembered accurately, and even said that her purse contained twenty francs. Finally she demanded the punishment of the individual. If I can suggest amnesia successfully concerning any previous period of time, or concerning certain cerebral dynamisms of an individual (for example, an acquired language), I can suggest equally well a fictitious plus of memories, in so far as I can bring the corresponding conceptions into his brain. If I tell the hypnotized individual: "You can speak Sanskrit," he will not be able to do so (if he has not learned the language). But if I say: "You have experienced, done, said, thought this or that, etc.," he believes that he has said, done, and thought so, and completely assimilates the suggestion with the memories of his previous life, and even supplements them where the hypnotizer has left gaps (for example, in the above-mentioned case, the contents of the purse). A boy of eight years, whom I demonstrated to the Legal Society of Zurich, swears, at my suggestion, that one of the lawyers standing before him robbed him of his handkerchief a week before. He adds, when asked concerning it, the exact place and hour. Five minutes later I suggested to him that this had not occurred and that he never maintained it. With equal boldness he denies the testimony which he had given a moment before.

It is Bernheim's great merit that he explained this important fact clearly by means of numerous illustrations. He has even given such retroactive suggestions collectively and thus

produced a series of false witnesses who gave their testimony with the most profound conviction. He has pointed out that particularly in children, who have an instinctive tendency to accept everything, to a greater or less degree, that is told them in a certain tone by adults, such deceptions of memory are produced very easily in the complete waking condition. But inasmuch as in many cases, when strong impressions act upon the fancy, suggestion may be successful even without a previous hypnotic sleep, particularly in children and weak individuals, we see how great is the danger of suggesting false testimony, especially false confessions, at the hands of judges. Bernheim has also pointed out that, in fact, such cases have undoubtedly occurred in criminal procedures. Lawyers will certainly be able to find many such in the history of notorious cases.

In psychiatry we have long been acquainted with cases of false self-accusations, in which the insane accuse themselves with the most accurate details, of a crime which had not been committed, and presented themselves to the court for punishment. We are also acquainted in them with the occurrence of false accusations against others. These facts have been regarded hitherto as simple delusions depending upon the basis of the delusion of committing crime, or of persecution, or upon hysteria or mania, etc., and this is generally true. The patients are convinced of the fact; indeed delusions in general are imperative auto-suggestions dependent upon insanity. But there are cases in which these self-accusations possess a typical suggestive character and are associated with very slight mental abnormality. I have observed a man who accused himself of a murder which had been committed in reality by another; this individual presented only a slight melancholic depression. In a few days he became rational and stated that the murder in question had created a profound impression upon him. Shortly before, he had spoken with a woman who had harbored the murderer and it then seemed suddenly to him as if he had committed the murder. All the individual circumstances which his fancy depicted appeared to him as if they had been experienced by him. He was convinced, and could do no other than place himself at the disposal of the police and to confess everything. Now it was clear to him that this was all a deception, like a dream.

A similar condition is found in many hysterical individuals and fanciful liars. These individuals lie constantly to others and to themselves, but are, in fact, unable to distinguish what has actually occurred from what they have invented. They feign half consciously or unconsciously. Psychologically they are misconceived entirely if the importance of conscious lies is attributed to their false statements. They are instinctive liars; they can do no other than lie, even when they are reproached, chastised, or despised, when all possible strict and stern measures are employed to make their lies hateful to them, they continue automatically, unconsciously, to feign the most stupid and useless stories. In my youth I observed carefully such an unlucky comrade and attempted to cure him in the most different ways without any result. He had inherited this auto-suggestive character from his mother, whom he had never known, as she abandoned him a few weeks after his birth. We have to deal here with a constitutional, cerebral, or mental error which is probably not unrelated to an habitual morbid auto-suggestibility.

Simulation and Dissimulation of Hypnosis.—From all this it must be evident to every rational man: 1, that the statement of those sceptical “*esprits forts*” who briefly dispose of hypnosis as a swindle, is based upon prejudice without personal examination of the facts; 2, but that, on the other hand, as all the better experimenters have shown, careful criticism and self-criticism are necessary in hypnotic experiments. There are people who, from a morbid thirst for swindling or lying, simulate the symptoms of hypnosis half unconsciously. These are usually hysterical individuals, or the above-mentioned liars, but as these people, as we have seen, believe their own lies, their hypnosis is neither entirely real nor entirely simulated. They sport with it, add auto-suggestions, often obey those suggestions which suit their fancy, and the like. The more fantastic and theatrical the suggestion, the better it usually succeeds in them. These are extremely unreliable witnesses. Certain schools, particularly that of the Salpêtrière, have fallen unfortunately into the great mistake of utilizing such individuals as the basis of their experiments. But there are others who believe that we only wish them to appear asleep, and who simulate “as a favor to the experimenter.” Bernheim calls attention to this class. It is very

easy, however, to discover the source of this deception, by self-control and by carefully put questions. On the other hand, there are vain individuals who are afterward ashamed to have been hypnotized, and who maintain that they have simulated, although, in reality, they had been well hypnotized. Bernheim has called special attention to these cases, which I have also observed a few times. If this is suspected, a few properly applied suggestions usually suffice to compel them to make a spontaneous confession of their false statements. Others, again, have a real belief that they have not been hypnotized because they are not amnestic. "They did not attempt" to draw the arm down. A bold challenge here suffices to convince them: "Now try with your whole force; I will allow you; I beg of you; but you are unable to do so." If we manifest distrust of a hypnotized individual, we may in this manner, without noticing it, give him the suggestion that he has simulated, and thus induce him to make a false confession of simulation (auto-suggestive deception). I have seen a classical case of this kind caused by a distrustful physician.

The hypnotized individual, a man, came to me in tears, and confessed that he had not slept; that everything had been a fraud. He had felt all the pricks of the needle; had only performed the post-hypnotic phenomena in order to favor me, etc. Next to him stood, with a grave countenance, the physician, who had obtained from him this confession (as a matter of course by suggestive questions, put with the best motive). I believed him apparently, gave the hypnotized individual a lecture, told him he should be ashamed of himself to manifest such want of character, and made him promise that henceforward he would tell the whole truth. This he did with the most profound emotion. Touching as the scene was, I knew very well that he had not simulated, because he had been deeply hypnotized, entirely somnambulistic. His facial expression during hypnosis and on awaking, could not have been simulated. Immediately after the promise and the reconciliation I again hypnotized him in the presence of the physician. I then suggested anæsthesia of the hand. He still felt the first two pricks of the needle, and stated this during the hypnosis. The subsequent ones he did not feel and at once denied that he felt them, and the other suggestions succeeded as before. After awaking, he stated that he had felt

two pricks of the needle, of all the rest he knew nothing, although the many later pricks of the needle were much deeper than the first. The hypnotized man was thus quieted and the physician received a lesson.

It is evident that the last two categories of deceptions offer no great difficulty, while the first can often not be cleared up on account of its inextricable confusion with true hypnosis. There remains only a clearly purposed simulation for a definite reason. This may occur, and may deceive at the start, because we must be cautious in the first hypnosis of an individual, but the simulant runs the risk of being caught, that is, of being hypnotized, if he plays his part too well. If he does not, he will not long deceive an expert experimenter. Moreover, the matter merely possesses the value of a tolerably stupid joke which few will perpetrate, especially not the sick who desire relief.

Significance of Suggestion.—In view of what has already been said, we may discuss this briefly. The chief importance of suggestion is psychological and psycho-physiological. It gives to the psychologist the experimental method of natural science, which he has hitherto lacked. What a wonderfully fine and manifold reagent it is with which all the qualities of the soul, in the finest shades of ethics, logic, and æsthetics can be influenced and modified.

On careful consideration, suggestion also appears as an inroad upon the associated dynamics of our mind. It dissociates what was associated, and associates what was dissociated; but its main action is inhibitory, a dissociation of the associated (unconscious) mental (cerebral) automatisms. The dissociated dynamism of the cerebrum of the hypnotized is in a condition of weakness and hypotaxia as opposed to the well concentrated and associated dynamic of the hypnotizer, which is forced upon it by means of the organs of sense. Its activity becomes plastically pliable and must yield irresistibly to the suggestion. The cause of his subordination does not reside in an especial strength on the part of the hypnotizer, but in the subjective feeling of subordination on the part of the hypnotized. In normal sleep we are all in a condition of hypotaxia or weakness, of dissociation, and confuse all our thoughts (dreams) with actual occurrences. Hence sleep is so useful for suggestion. In sleep, the more vigorous brain must yield to

the suggestions of the otherwise feeble, but now waking and therefore more vigorously associated one; but if the mind A (a brain) has been vigorously influenced in this way by another, B, the memory, which produces the conviction that the soul, B, has the power of acting upon the soul, A, produces the disposition to a subsequent constantly increasing influence by B. In reality, however, it is the activity of the mind, A, which carries out the powerful suggestive actions. It is only guided, dissociated, associated, inhibited or stimulated to the most vigorous activity by the mind B. The taming of lions and elephants depends upon similar processes.

B employs only the dynamisms present in A which act in the manner peculiar to the mind, A, and which follows the suggestions of B only because they are no longer capable of a conscious concentration against B, and are unconscious of their own strength. The dynamisms of A are therefore constantly overcome, more and more, by B's suggestions and follow them more and more automatically.

We find entirely similar phenomena in the influence of men upon one another in political and social life. We find them in the leaders among children, as among animals; in certain prophets and chiefs; in whites as opposed to the negroes; in Napoleon I. and Bismarck as against Europe; in the victor against the vanquished in general, both in men as well as in animals. Indeed, similar nervous phenomena can be observed even in insects (ants) (Forel, "*Fourmis de la Suisse*," 1874, p. 314), when after a bold attack by a few small ants innumerable larger and stronger ones run away without resistance and courage, forsaking in a cowardly manner their otherwise most carefully nurtured larvæ and pupæ. This is also a striking suggestive action. Too much importance, however, must not be attached to these analogies, plausible as they are. They are merely analogous processes.

As we have seen, suggestion is practically important in medical therapeutics. It acts most successfully in little matters, headache, loss of appetite, etc., and in all sorts of habits. Habits themselves are auto-suggestions. Here we see the intimate psychological relationship of suggestive action with the automatism of dynamic associations, with the formation of habits, with automatic unconscious cerebral activity in general.

This brings us to the pedagogic importance of suggestion, which has been discussed considerably in recent times. Whoever fails to understand suggestion is terrified by this thought. But the one who understands it thoroughly will desire it to be employed pedagogically in two ways: in the first, symptomatically, as it were, medically, in order to combat bad habits, perverse peculiarities of character. Here it must be employed as in therapeutic hypnosis, and, as in the latter, we must attempt, not to utilize it *ad infinitum*, but only so long as necessary. We must endeavor in every way to convert the result into a permanent one, which aids itself by properly conducted auto-suggestions.

In the second place, suggestion, considered from another standpoint, becomes one of the most interesting problems of future pedagogies, of the developmental history of psychology. Every one knows that there are teachers, parents, instructors, who make of the children whatever they wish, while others attain the opposite and experience only insubordination and resistance. This depends solely upon the fact that children are subject to the unconscious suggestive action of the former, but not of the latter. Repeated unwise reproaches, scoldings concerning their non-respected (for example, paternal) authority, the exhibition of temper, in short, the exposure of weaknesses, are, as is well known, those factors which produce in children insubordination, resistance, and thus, obstruction to education. But, on the other hand, whoever understands how to advocate his counsels as a matter of course, as unavoidable, as beyond discussion, does nothing less than to suggest instinctively. The exaggeration of these methods, especially their continuance to a later period than childhood, offers the danger of developing blind belief in authority and lack of independence. At the proper time and place, the spirit of rational discussion must be invoked. But if we have once understood that the key to these actions and reactions lies in the proper application of suggestion in children, pedagogies will learn consciously to employ what has been used unconsciously hitherto, and will thus derive enormous advantage.

Nature of Suggestive Action.—Concerning the nature of suggestive action, we can only express surmises. From the fact that we attempt to give to the suggested conception the subjective character of an occurring fact, that is, of the per-

ception or action, or the inhibition of both, and that this indeed succeeds; furthermore from the fact that a series of these results affect palpable or ponderable exercises of force (muscular activity, menstruation), the assumption seems to be justified that suggestion releases in the central nervous system, by means of the conceptions, dynamisms which qualitatively and quantitatively are more or less co-ordinate with those of the suggested nervous activity when based upon a real cause, or actually occurring; while, at the same time, they differ from the conception proper, being much stronger and qualitatively different.

Illustrations.—I suggest to the hypnotized individual that he sees a cat. He sees it. The complex of activity of his brain thereby produced is very similar to, if not identical with that produced in the brain by the reception of the rays of light from an actual cat, while it is entirely different from the simple conception of a cat. An entirely similar action holds good with the catalepsy, actions or menstruation produced by suggestion as compared with the mere conception of these conditions. It is the relation of the so-called profounder condition of consciousness as opposed to the correspondingly weaker ones (vide, for example, Herbert Spencer's *Psychology*).

It is extremely probable that this unconscious conversion of a conception into a perception, of the image of an action into the corresponding action, of the conception of a vasomotor effect into this effect itself, of the conception of anæsthesia into the anæsthesia itself, is only rendered possible by the abolition, *i.e.*, the inhibition or dissociation of the organically associated contra-conceptions which maintain the equilibrium. By the abolition of the associated dynamic complex of forces, which effect the internal, in part, unconscious logical discussion, the suggested conception becomes all powerful and gains the highest development of nerve force, which is propagated into the peripheral nervous system. Similar peripheral irradiations also occur evidently in a simple conception, as physiologists (Stricker) have already shown, but they are too feeble to produce material results. We may here use the term reflexes, but this is merely another word.

Free Will.—After all that has been said, it need hardly be mentioned that with the assumption of free will, the suggest-

ive effects must remain inexplicable, because they constitute its negation, and that our apparently spontaneous activity of thought and will must depend upon auto-suggestion, that is, upon the actions and reactions of our cerebral forces (nerve forces in general), the crests of whose waves we are alone conscious of. We will, however, remind the reader that for centuries the best philosophers have denied the existence of an essentially free will.

Suggestion and Mental Disturbances.—Lunatics are the least suggestible of all people. Severe cases of insanity are not at all suggestible. Herein all experienced hypnotizers are agreed. This is owing simply to the fact that the morbid inhibitions or conditions of irritation in the brains of lunatics attain such an intensity that they can no longer be dissociated by suggestion. Even if we succeed in hypnotizing a lunatic, the majority of curative suggestions act not at all or only temporarily, and least of all, those which are directed against delusions. A lunatic, Mrs. X., considered herself to be Mrs. Y. I was able to hypnotize her, and succeeded in suggesting sleep, appetite, and even post-hypnotic hallucinations, but when I explained to her during hypnosis, with the greatest energy, that she now is perfectly well aware that she is Mrs. X., and not Mrs. Y., that the latter opinion had been a nonsensical delusion, concerning which she now could only laugh, she shook her head in the negative constantly during the hypnotic sleep (that is, so long as I made this statement) in order to show me that she did not accept the suggestion.

In suggestion we work with the cerebrum of the hypnotized as an instrument. In lunatics the function of this instrument is disturbed, therefore it works poorly. The failures in insanity are one of the best proofs that the power of hypnosis resides in the brain of the hypnotized, not in that of the hypnotizer.

This sketch of hypnotism cannot be concluded better than by the expression of Bernheim: "Suggestion is everything." The sleep itself is merely the effect of suggestion, although it forms one of the most powerful aids on account of the dissociated condition of the mind inherent in it and which notably increases suggestibility.

CHAPTER III.

CONSCIOUSNESS AND SUGGESTION.

THE old problem which constantly meets us in psychology is that of our consciousness. Clear and simple as the word consciousness sounds, the fact or corresponding notion is equally complicated. Indeed, this notion is undefinable, because it coincides at every moment with that of our subjectivity, our conscious ego. Consciousness is the internal subjective mirror which illuminates a part of our cerebral activity and thus stamps that part as ours, as our cognizing mental ego.

In a lecture on memory, I expressed myself, therefore, incorrectly when I said that consciousness is an activity. We may apply the word consciousness only to this internal illumination of a part of the cerebral activity, not to the activity itself. It is, nevertheless, true that we cannot conceive of consciousness without activity.

In order to understand the relation of our mind to our brain, it is, in my opinion, of prime importance, that we limit the conception of the word consciousness in the above-mentioned manner. For example, if we confound it with the notion of the Ego, of our personality, we mix a large number of not always conscious cerebral activities with the purely subjective notion of consciousness, and thus do not escape from the confusion. Every one has, more or less, the subjective feeling that his entire feeling, will, cognition, and knowledge occur with consciousness, because at every moment of life he can only account to himself for that part which, as we say, "he can call into consciousness," that is, which he can illuminate by consciousness.

This feeling, however, is the source of most marked subjective deceptions whose climax is found in the dictum of the old pure spiritualists (in the philosophical sense) so drastically

satirized by Molière in his "Le Mariage Forcé." "The whole world appears to me only as a condition of my consciousness. Outside of my consciousness I know nothing. Hence the world does not exist; only my consciousness exists."

Sganarelle answers the philosopher Marfurius, who expressed similar ideas, by saying: "I only appear to be beating you."

Induction, that is, experience, constantly shows us that there is really an external world, although our perceptions often deceive us, often do not bring actualities to our knowledge; on the other hand, often simulate what is not real, and, in general, only furnish us with a relative and symbolic knowledge of the world, that is, with a knowledge only of those forces of the external world, which, when transformed, can be propagated through our senses into the brain and there, remodelled, appear in the mirror of our consciousness.

If we hold fast to the monistic idea that there is only one cerebral activity which forms but a part of the nervous activity whose greater point of concentration constitutes attention, and which produces only in résumé (not in its individual dynamisms) the internal illumination that we call consciousness, and usually only at these points of concentration, then hypnotism loses in great part its problematic character. Even in our normal waking condition we can observe this introduction and removal of the mirror of consciousness and particularly of the conscious illumination of our memory images. Often it is impossible to become conscious of a known name, and perhaps so much the less the more we seek it. Somebody relates a tedious story; suddenly we no longer hear him (some are still conscious of a murmur; others hear nothing at all), etc. In hypnosis such introductions and removals of consciousness are produced purposely by suggestion and the conscious part of the cerebral activity is constantly astonished by the results of the suggestions which are produced in an unconscious manner. The suggestion given is usually heard and understood consciously, and its actual success also is usually perceived consciously, but the mechanical connection between the two, between cause and effect, remains unconscious, and it is this separation of such unconscious dynamic associations, attended with the coincident development of others, which acts so astonishingly. When, by suggestion, I make an

arm motionless, this is only the inhibition of an old automatically associated complex of motor images. When, by suggestion, I allow water to be drunk as chocolate, I have simply, without the adequate sense stimulus, called forth to an hallucinatory height the old conception of the taste of chocolate which rested unconsciously in the brain and associated it with the perception of the cup and the fluid. When, in some individuals I can easily introduce and remove the mirror of consciousness and can inhibit or guide the attention, I will soon be able to do so for large complexes, and in this way everything is explained. We should note, at the same time, what is too often forgotten—that our human consciousness is solely a reflection of the concentrated activity of the cerebrum. After division of the cervical spinal cord, we are clearly and completely conscious only of the activity of that part of the nervous system which is situated on the cerebral side of the injury. If the spinal cord possesses consciousness (Pflueger), the lower cerebral consciousness is not conscious of this spinal consciousness. An amputated individual experiences pain in the fingers which are no longer present, when the former paths of conduction to the fingers, the nerves of the arm, are irritated at the stump. Disturbances of the cerebrum alone impair consciousness. Hence activities of other parts of the nervous system only become conscious when they are propagated to the cerebrum, and there produce an adequate stimulus. If this point of stimulus of the cerebrum is afterward, by an unusual path, brought into a condition of renewed or similar movement, it appears in the mirror of consciousness as on the first occasion, and the original cause is often erroneously attributed to it (consciously or unconsciously) by the judgment, that is, by other cerebral dynamisms. In this way the hallucinations of lunatics and all other possible deceptions of our mirror of consciousness, develop. On the other hand, cerebral activities, whether subjectively conscious or not, are propagated centrifugally into other (sub-cortical) parts of the brain, into the spinal cord and the peripheral nerves, and may there exercise considerable effects.

How the use of words, such, for example, as “seeing,” “willing,” is abused. Does a pigeon which has been deprived of its brain see or not? There are many degrees of vision: 1, the elementary amœba-like vision of the retinal elements.

2. The vision of the anterior corpora quadrigemina and the corpus geniculatum externum (secondary or sub-cortical optical centres), which have already received a co-ordinated transmission of the retinal image through the optic nerve. This is the vision of the pigeon deprived of its brain.

3. The vision of the so-called visual sphere of the cerebral cortex (cuneus), which exists despite the physiologist Golz, inasmuch as the system of fibres from the sub-cortical centres there terminate (Monakow). The visual sphere receives the retinal image from a second hand, if we may use this expression, and combined with much more complicated associations.

4. There is still another vision—a more mental vision—namely, the repercussion of these optical stimuli of the visual sphere in other associated cortical tracts of the cerebrum. There are even individuals who see tones in colors (Nussbaumer, Bleuler, Lehmann).

This also holds good with regard to centrifugal or volitional activity from the conscious wish through resolution and action down to reflex twitching. The study of disturbances of speech shows very clearly that there are no boundaries between somatic and psychical motor disturbances.

If we group together all these facts, the apparent contradictions and puzzles in hypnotism will no longer astonish us to such an extent. We will understand more easily that a hypnotized individual sees and does not see, believes, and yet often simulates, apparently with a certain degree of pleasure. His consciousness may believe, and yet not see or hear, for example, in a negative hallucination, while outside of the mirror of consciousness which is only excluded to a slight extent (as if covered by a veil) his entire remaining cerebral activity (his second consciousness, as it has been called) sees and hears accurately and escapes the obstruction. In another case, however, a concentrated, profound suggestive action may extend much more deeply into the unconscious cerebral activity, and, radiating into the peripheral nerves, may even react strongly upon them, as we see, for example, in the inhibition and production of menstruation, in the production of diarrhœa, and epidermic vesicles. We must interpret in a similar manner the wonderful cases of so-called double consciousness (case of Macnish; Férida of Azam). This holds good also with regard to the double consciousness possessed by every individ-

ual, namely, dream consciousness, and consciousness in the waking state.

If we bear all these facts in mind, the dispute concerning the value of negative hallucinations, recently entered into between Delbœuf and Bernheim in the "*Revue de l'Hypnotisme*" will be deprived of a subject.

CHAPTER IV.

HINTS FOR HYPNOTIC PRACTICE.

IF we wish to hypnotize, and particularly to secure therapeutic results thereby, we must first arm ourselves with great patience, enthusiasm, persistency, an assured demeanor, and with ingenuity in devising stratagems and manipulations.

This indicates that not every physician is a suitable hypnotizer. It is true that the personal magnetic fluid, formerly regarded as necessary, is a superfluous myth, but not every one possesses the characteristics above mentioned. By far the greatest foe to success is the *vis inertiae* which inheres so strongly in the majority of mankind, which constantly falls asleep unless again made to flicker as a result of the unavoidable frictions of life. Whoever hypnotizes in a routine manner, after a certain scheme, will soon have very little result when the stimulus of novelty is past. He will constantly fall more and more asleep, his patients less and less.

The second foe is mistrust, the anxiety, the dread of the laughter of others, of the simulation of the hypnotized, the doubts and fears of all kinds. This second foe, which is originally the greatest, soon disappears after some practice, and the first mentioned then acquires its full importance and must always be combated. Indeed, we can often observe that when we are in a depressed mood or tired, we effect less successes, because this weakness on the part of the physician is perceived unconsciously by the cerebral dynamism of the hypnotized.

As Bernheim advises, we should approach the individual to be hypnotized in a perfectly natural manner, explain to him that it is nothing unnatural or magical, but a simple property of the nervous system inherent in every individual and that he will easily fall asleep or slumber. We should avoid many words and explanations and place the patient or non-patient upon a comfortable chair. It is preferable that the chair have

no arms, and, at one side, should be placed close to the wall, in order that we can aid a still uncertain suggested catalepsy of the arm by leaning it against this wall.

We must enjoy, or attempt to obtain as far as possible, the confidence and favor of the one to be hypnotized.

The individual should not be mentally excited, anxious or in a condition of intense expectancy. The latter spoils the first hypnosis in very many intelligent people who imagine and expect the most wonderful phenomena. Many are afraid that they cannot be hypnotized and therefore make this auto-suggestion, which is often destroyed with very great difficulty. We must here rely upon patience and all sorts of devices. The first attempt then usually fails. We should explain to the patient that he is too excited for the moment, has interested himself too much, but that he is already influenced—that sleep is by no means necessary in order to produce success, and that later it will occur spontaneously. We speak of light slumber, etc. On one occasion (I had exhausted in vain all my manipulations in this manner) I asked the lady to call again the following day; permitted her to rise, put on her gloves and cloak, and then I arose and said to her in an apparently indifferent manner: "Please be seated for a moment," and with a few rapid and assured suggestions she was hypnotized in a few seconds.

In such cases it is in general very advisable to make several successive attempts with intermissions. We must also attempt to deflect the attention of the patient from his idea "it will not succeed in me." In many of these cases the hypnotization of another person in the presence of the one to be hypnotized is very advantageous.

The patient is placed upon the chair, looks into our eyes from a few seconds to one or two minutes, and, at the same time, we explain to him in a loud and positive but monotonous tone that everything is going excellently, that his eyes are already moist, his lids heavy, that he feels an agreeable warmth in his legs and arms; then we allow him to look at two fingers (thumb and index finger) of the left hand of the hypnotizer which are slowly lowered in order that the lids may follow. If the lids close of themselves, the game is won. If not, we say, "Close your eyes." We then lift an arm and lean it against the wall, stating that it is stiff. It is best to

explain, at the same time, that the hand of the corresponding arm is drawn hypnotically and irresistibly against the head. If this does not happen, we help a little, grow very decided and intense in the suggestions, finally suggest disappearance of thought, obedience of the nerves, rest, slumber. As soon as it is noticed that one or the other suggestion begins to act we utilize and emphasize this, and allow the patient to give us information concerning it by nodding the head. Every affirmed suggestion is at the start a considerable gain, which we must utilize for further suggestions: "Do you see? Everything is going well. You are sleeping better and better; the arm is growing stiffer; you can no longer bring it down" (the patient attempts this with some success). "On the contrary, if you wish to bring it down, it will go up toward your head. You see, I draw it constantly more and more toward the head," etc.

It is best to touch the painful part (head, abdomen, etc.) with the left hand, and to explain at the same time that the pains disappear. We ask the patient during the hypnosis concerning the result, and if possible, do not stop until the success is complete (momentarily). For this purpose we often require several different suggestions and must exercise ingenuity. In very suggestible people everything succeeds at once; in others great difficulty is experienced.

We must attempt to secure anæsthesia as rapidly as possible and also amnesia after waking. It has occurred that many curative suggestions succeed without these two results, but as a general thing, we succeed better and more rapidly with them. By means of the amnesia we prevent the patient from conveying the threads of his conscious logic from the hypnosis to the waking condition, and vice versa.

It is furthermore a serious duty of the hypnotizer to prevent the injurious results of auto-suggestions. Hysterical, but also other anxious, nervous individuals are apt during the first hypnosis to develop auto-suggestions of its injurious effects, especially when they are full of the subject from reading newspapers or the remarks of others. They are dizzy after the hypnosis, or they feel dull, or have feelings of anxiety or headache, even tremor, or twitchings which may increase to spasms. When this occurs we must be on our guard to avoid exhibiting anxiety, or the auto-suggestion will be thereby in-

creased and cultivated. On the contrary, we must declare with great positiveness and confidence that these are small matters which occur occasionally in the first hypnosis, but are relieved at once and never occur again, and in saying this we suggest the disappearance of the phenomena *in toto* by an immediate renewed hypnotization. We may allow none of them to remain and must bear in mind that everything produced by suggestion can also be relieved by suggestion if it is suggested away at a sufficiently early period and not allowed to become fixed. In such individuals, in hysterical subjects in general, hypnosis should be made brief, and used only a few times, and only therapeutic suggestions should be given.

To this procedure I attach great importance. To its ignorance or neglect, according to my firm conviction, all the unintentional injuries by hypnotism which are reported in literature, owe their origin. I have seen a case of trembling and pains in an arm produced by such unskilful hypnotization on the part of an inexperienced young man and which continued for months.

It is self-evident that we can injure by suggestion, if we so desire, as this is only the reverse of its curative action. We can suggest headache, menstrual disturbances, etc., as well as suggest them away, but if we desire to achieve only good, we must never speak to the hypnotized of the possibility of injury. On the contrary, we must always maintain firmly and unconditionally that the suggestion can only produce good. We thus prevent in the best manner injurious auto-suggestion.

By the same method of contra-suggestion, we must prevent the falling into self-hypnosis, the weakening of the will power, and other things of this kind, whose danger is constantly maintained against therapeutic hypnotism. On a single occasion one of my 250 hypnotized persons fell spontaneously into a hypnotic sleep, but received such a vigorous suggestive lecture that the case was never repeated. If we recognize the justification of the occurrence of such phenomena, they will soon be repeated not alone in the same individual (as, for example, in the hypnotized, hysterical patients of Von Krafft-Ebing) but also in others. On the other hand, self-hypnosis suggested by an amulet is free from danger, but we must restrict its duration by suggestion to a few minutes, and permit its occurrence only by the amulet in question.

In addition, we must always suggest complete euphoria, cheerful mood, good sleep, and appetite, and strengthening of the will. Furthermore, the rules of Bernheim and Liébault should always be carried out:

1. In all hypnotizations, at least one witness should be required—as a protection for the hypnotizer as well as for the hypnotized.

2. In all very suggestible persons (sommambulists) the suggestion should be given that no one else can hypnotize them.

3. No one should be hypnotized against his previously expressed wish.

4. Suggestions should be given only for therapeutic purposes in so far as juridical, scientific or didactic purposes do not come into question.

We must always observe carefully the individual suggestibility of the patient, act accordingly, and not according to rigid routine.

If suggestive anæsthesia is to be employed for surgical purposes, the patient must first be prepared by a few hypnotizations. If he no longer feels the pricks of a pin in the palm of the hand, or contact with the cornea, he is ready for the operation. But we must avoid exciting his mind by great preparations for the operation, or we will run the risk of dissuggesting him (I have observed this in a number of cases). We must hypnotize him beforehand, declare that the operation is a mere nothing, and thus surprise him with it as far as possible. During the operation, the anæsthesia of the corresponding part of the body must be continually suggested.

If suggestion fails in any one, the method is to be interrupted for four or five sittings. It then often succeeds at a later period by another hypnotization.

No one may be hypnotized mechanically *ad infinitum*. We only lose thereby and gain nothing. We must attempt to gain as much ground as possible rapidly in a few sittings. Then we must gradually reduce the originally daily hypnotizations and then discontinue them, the result which has been obtained being declared definitive, permanent. There are obstinate individuals of less suggestibility, however, who, nevertheless, recover after a longer time and greater persistence. But everything has its limit. If the patient no longer sees

any result, he is thereby often dissociated, and we thus lose influence instead of increasing. We must constantly endeavor to obtain something new until the end is reached, and then must gradually cease.

The hypnotizers are often dissuggested by auto-suggestions as well as by the remarks of other individuals, readings which criticise hypnotism, etc.; often by the fact that the hypnotizer himself loses courage and confidence. As a general thing, however, the lost ground may be regained by energy and trouble. Things often go better after a prolonged interval.

As Bernheim correctly says, hypnotism may be employed therapeutically, not only alone, but also in combination with other measures. Many curative measures may be employed as auxiliaries of suggestion or directly as suggestion, and there is no doubt that a large number of medicines have acted solely in this way. Homœopathy offers a striking proof of this fact.

Many pains which will not yield to simple suggestion yield to colored water or bread pills. Bernheim and Wetterstrand have shown the suggestive action of metallotherapy, and, in part, of electricity.

I have repeatedly emphasized that suggestion is not a panacea which cures everything. If we expect everything from it, we will be deceived. Much can be attained, however, especially if we act with persistence, judgment, and medical knowledge, and understand to unite suggestion with other remedies. For example, if stuttering cannot be cured entirely by suggestion, it is combined with a systematic treatment (exercises in breathing, vowels and consonants). If verbal suggestion alone does not succeed in relieving a woman of sea-sickness, she may be rocked thoroughly during hypnosis while the suggestion of feeling well is given. It will then probably succeed.

I will here mention those morbid conditions which seem to me to yield best to suggestion, although the indications are by no means determined with sufficient certainty, and undoubtedly much will yet be added:

Spontaneous somnambulism.

Pains of all kinds, especially headache, neuralgia, sciatica, toothache, which does not depend upon abscess, etc.

Insomnia.

Functional paralyses and contractures.

Chlorosis (very favorable).

Menstrual disturbances, metrorrhagia, amenorrhœa, anorexia.

Constipation and diarrhœa (if the latter does not depend on catarrh).

Alcoholism and morphinism.

Rheumatism.

Surgical anæsthesia for slight operations.

Neurasthenic disturbances.

Stuttering, nervous visual disturbances.

Night fears of children.

Nausea and sea-sickness; vomiting of pregnancy.

Nocturnal enuresis (often very difficult on account of the profound normal sleep).

Nervous attacks of cough (also in emphysema).

Hysterical disturbances of all kinds, including hystericepileptic attacks, anæsthesia, etc.

Bad habits of all kinds.

Many other affections are mentioned in literature, concerning which Liébault, Bernheim, and other works may be consulted. The above list will suffice at the beginning for every one, and later we may form our own indications.

CHAPTER V.

ILLUSTRATIONS OF CURES BY SUGGESTION.

It would exceed the limits and purpose of this little work were I to give statistics. These have already been published, and I refer particularly to Bernheim's classical work. I will merely mention in brief two illustrations:

1. A thoroughly honest servant was attacked in the summer of 1888 by profuse menstruation, which increased in the autumn to such an extent, despite all medication, that the menses occurred every two weeks and lasted a week. The originally anæmic girl thus became extremely anæmic, almost as pale as a corpse. She had lost her appetite and sleep, dozed at night with heavy dreams. The gentleman in whose service she was, described her condition, and believed that she would be compelled to return to the country to her family. I asked him to bring the girl for consultation. This occurred on the evening of the fourth day of menstruation. I allowed her to sit upon the chair and look at me and hardly had she seen my finger when the lids closed. I now suggested catalepsy, anæsthesia, etc., with immediate success. This gave me the confidence to suggest the immediate cessation of menstruation. This suggestion, attended by touching the abdomen, and the explanation that the blood would pass from the abdomen into the legs and arms succeeded in a few minutes. At the close I suggested good sleep and appetite. I directed that she allow the menstruation to be carefully controlled by the mistress of the house. The menstruation ceased completely and the girl slept quite well on the following night. I again hypnotized her a few times and prescribed the next menstruation for four weeks later, slight and only lasting two and a half days. At the end of three or four days, I had secured by suggestion sound sleep, and, after a week, a fair appetite, also regular daily evacuations of the bowels, in the morning

after waking (previously the patient had been obstinately constipated). Thenceforward the girl improved daily. The next menstruation occurred in twenty-seven days (one day too early) at the suggested hour, was very slight and lasted only two days. Since then the girl has menstruated regularly every four weeks; the menstruation remained very moderate, and lasted at the most three days. After a few weeks color returned to the face, and since then the girl has worked regularly without disturbance, although she remained somewhat feeble and anæmic. She has not been hypnotized since, with the exception of one occasion, when she was again somewhat prostrated and had lost appetite (April, 1889).

2. An old alcoholic, æt. 70 years, who, ten years before, had twice cut his throat, during delirium tremens, was treated from 1879 to 1887 as an incorrigible drunkard and vagrant in the Burghœlzli Lunatic Asylum. All opportunities to get drunk in secret were utilized. During drunkenness he had hallucinations, and became dangerous to himself and others. At the same time he was the greatest foe to my attempts at securing abstinence in the alcoholics of the institution, and although otherwise good-humored, he stirred up the others against the temperance society. In later years he suffered considerably from rheumatism in the back, which interfered with him greatly in working. The slightest freedom could not be granted him without immediate resort to drink. I had long given him up, but in 1887 attempted to hypnotize him. He proved to be very suggestible, and in a few sittings I succeeded in making him very serious. His intrigues ceased like magic, and after a while he asked that the wines be discontinued, which I had still permitted him in small quantities because I had regarded him as lost. Soon afterward, the rheumatism disappeared entirely by suggestion (and never returned until the beginning of March, 1889). The patient improved and soon became one of the most enthusiastic abstinents of the institution. For a long time I hesitated to give him a free pass, but finally did this in the summer of 1888. This freedom, during which he always received some pocket money, was never abused. He remained absolutely abstinent, entered the temperance society at suggestion, and since then has been a very enthusiastic member. On his trips to the city he drank only water, or coffee and the like. On account of his

total inability to resist alcohol it would have been impossible for him to have taken a single glass without escaping notice. Recently he took cold and suffered a severe relapse of his rheumatism. In three hypnotizations (within twenty-four hours) this was entirely relieved, and although seventy-two years old, he has since worked more steadily than ever. In the course of the last nine months he was only hypnotized a few times for purposes of demonstration. He no longer requires anti-alcoholic suggestions.

These two cases, it is true, are among the best results, but similar ones are obtained in the majority of patients who are brought into a tolerable degree of somnambulism, and even in many cases of simple hypotaxia we can obtain very many improvements and also recoveries. Unfortunately, the Director of a Lunatic Asylum has the most unfavorable field conceivable for hypnotic therapeutics.

CHAPTER VI.

JUDICIAL SIGNIFICANCE OF SUGGESTION.

TWO articles* on hypnotism have appeared in the "Zeitschrift." Von Lilienthal, in "Der Hypnotismus und das Strafrecht," first gave an admirable table of the phenomena in the domain of hypnotism which are of interest to criminal law. As is well known, these are found particularly in French researches. This article was written from the standpoint of the jurist, and throws light on the question in the clearest manner. Von Lilienthal reaches the conclusion that our present criminal law furnishes sufficient protection against the dangers of hypnotism to the rights of society. As a jurist Von Lilienthal has not, like ourselves, entered into a criticism of the different views of physicians.

Rieger's article, "Einige irrenärztliche Bemerkungen u. die strafrechtliche Bedeutung d. sogenannten Hypnotismus," is the real inciting cause for the following lines, inasmuch as I oppose his views in many particulars. Rieger assumes that hypnotism is a morbid condition; that only nervous, hysterical individuals (excluding psychical epidemics) are hypnotizable. He believes that France possesses hypnotism as it does hydrophobia, and that both are due to their imperfect police measures, calls hypnotism an artificial insanity, and formulates the following dilemma: "Either the entire matter merits no consideration in criminal law, because, although long known, it has no significance criminally, or it has only recently become significant because a new important criminal factor has developed because of the passage of our criminal statutes."

In our opinion, such complicated questions cannot be settled by a simple "either-or." Rieger considers hypnotism as insignificant, thinks that, like the Salvation Army, it could be forbidden by the police. His article concludes in polemics against the method in which hypnotism is practised in France. But it is evident that the writer did not separate the admira-

ble investigations of the Nancy school from the public sensational performances of the laity and the comments of theatrical clowns. (Without further investigation of the subject, Rieger regards the results of the Nancy school as a psychical epidemic like that of the dancers and other possessed individuals.) His article is not free from a national, political spirit, which, in our opinion, does not belong to the treatment of a scientific question. In the following remarks, I will avoid as far as possible trespassing upon the judicial domain, and will refer only to those facts which appear to me, in my experience as well as in that of others, to possess criminal importance. I refer the reader to the recently published work of Liégeois.

This work contains everything that we will here mention in brief, although we agree with Von Lillenthal that the subject is in reality not so dangerous as Liégeois thinks. On the other hand, we agree with Liégeois in his opposition to Delboeuf, who fails to recognize the gravity and criminal significance of suggestion. In the first place, we will mention the interesting fact that the hitherto observed and well-known peculiarity of certain individuals of being influenced very easily, as if instinctively and unconsciously, and without hypnotic procedure, is based upon suggestion. In some individuals this peculiarity is developed in a marked degree, in men as well as in women. They simply are unable to resist the influence of those with whom they are associated, are therefore the football of others and are generally subject to abuse. They are often called "infirm of will," yet they may be very intelligent, and are by no means always weak against their own passions. They may even exhibit great energy and persistence, but are incapable of resisting the suggestions of certain other individuals. The grossest facts do not bring them to reason, nor are they able to free themselves of the influence of him who has once mastered them, and who is not necessarily their intellectual superior.

On the other hand, we find individuals who understand how to bring others irresistibly under their control. These are the great natural hypnotizers, who, without conscience often abuse their gifts. Napoleon I. was an historical type of this kind. It is often believed that this is due to success alone, but this view is incorrect. In society we can often observe such individuals, who meet with many failures because

they are lacking in clear judgment, and who, nevertheless, act "magnetically" upon many others, especially upon women, and drag an entire series of them to destruction. Their victims not infrequently declare that they had simply been unable to resist the influence; that they had experienced a sense-deluding mental pressure. These facts resemble suggestion in the waking condition as much as one egg does another. To what extent this psychological relationship with a volitional non-free condition may be utilized in the future in criminal practice, is a matter for the law.

If we now pass to hypnotism in the narrower sense we must emphasize, as Lilienthal has done, that the hypnotized may be the subject of crime or may commit crime. I intentionally avoid giving extracts from literature in order to prevent repetition of Lilienthal's article. We will here concern ourselves chiefly with the bearings of suggestion.

It is clear that all conceivable crimes may be carried out easily in the hypnotized as soon as a somewhat higher degree of hypnosis is obtained. We have seen that too much importance may not be attached to the non-willingness on the part of the hypnotized, because this includes all possible gradations. A general knowledge of hypnotism on the part of the public will, however, make it better acquainted with its dangers and thus more capable of resistance. Mention has already been made of the precautionary measures recommended by Bernheim and Beaunis of procuring an authorized witness during the hypnotization and of obtaining a previous permit for the suggestions to be given. In practice, however, this second rule can be carried out with difficulty, and it is especially French writers who have sinned most sorely against it.

The hypnotized, however, carries another protection within himself. Enticing and easy as the commission of a crime may be to the hypnotized, its results are, on the other hand, equally dangerous to the criminal, for the entire structure upon which he bases his safety is a very fleeting thing that may be easily destroyed. The hypnotized sometimes wakes at the moment when we are least expecting it. We sometimes believe him to be amnesic and suddenly the memory of everything that has occurred again becomes conscious by some auto-suggestion. As a general thing, the hypnotized can again be hypnotized by another, and thus the most complete memory of the phe-

nomena during a previous hypnotic sleep may be restored to him. All the impressions which his brain received during the hypnosis have remained there. Only an inhibitory pressure prevents their consciousness, and this pressure can be removed. I believe that to the instinctive feeling of this fact on the part of the hypnotizer it is chiefly owing that hitherto such few crimes have been committed upon the hypnotized.

All these protective qualities, however, are lost in certain "better somnambulists" who are subject so completely and profoundly to suggestion that they can be used for all purposes with great security. It is very difficult to say what percentage of humanity belongs to this latter category, inasmuch as this cannot be decided in many individuals who have been hypnotized only once or twice. As we have seen, an individual who for some time could hardly be hypnotized at all, suddenly, when the proper point of attack for his individual suggestibility is found, is converted into a perfect somnambulist. The proportion of 15 to 20 somnambulists among 100 individuals and of about 50 among 100 children hitherto assumed by the Nancy school may therefore be increased considerably after sufficient practice and better understanding of suggestion. (This also appears to be true from the most recent publication of Bernheim.) On the other hand, the proportion is too high for the inexpert. Moreover the percentage of good somnambulists is increased quite considerably by so-called training, *i.e.*, with the number of hypnotizations performed upon each individual, although in many cases a certain slight grade of hypnosis can never be exceeded and certain somnambulists not infrequently lose their suggestibility by auto-suggestion.

I must here oppose a view entertained by Lilienthal, who thinks that a distinction from the criminal standpoint may be made between the lethargic and somnambulistic condition, inasmuch as he considers the lethargic individual alone as unconscious in the legal sense, probably as a result of the statements of Charcot. The speaking somnambulist with his open eyes is *de facto* as incapable of resistance as the only apparently unconscious lethargic individual. Taken all in all I believe that it is much easier to abuse suggestion in an indirect manner than to commit gross crimes by its aid.

At the head stand sexual crimes, which have hitherto been

reported almost alone in literature. These were cases of the abuse of deep hypnosis, of the performance of coitus by the hypnotizer, who is sure that his victim will not awake and will remain amnesic. This is undoubtedly true of all tolerably good somnambulists; indeed, of all deeply sleeping hypnotized individuals who can be made anæsthetic and remain amnesic. If we remember that of twenty-three nurses I could plunge nineteen into deep sleep, with amnesia and anæsthesia, the danger can be easily seen (apart from the danger of subsequent discovery). As a matter of course, murder and robbery can be easily committed upon such helpless individuals.

The misuse of the post-hypnotic actions of suggestion appears to be more complicated and important. We must wait, however, until such cases have come up for criminal consideration, but I believe that it is well to obtain a clear insight of the matter at the present time.

We have seen how these phenomena vary according to the individuality. A very interesting fact is the different individual ethical or æsthetical reaction of the normal personality to an unethical or unæsthetic post-hypnotic suggestion.

If I say to a hypnotized: "After awaking you will drink water from this glass," the suggestion succeeds without delay. If I add: "You will also place this chair upon the table," many will hesitate, will look at the chair, be abashed, laugh, and finally, some will not carry out this second suggestion, because they find the matter too stupid and nonsensical. If we ask what they thought, they answer: "I had a stupid idea of placing this chair upon the table." This thought, in the form of an imperative conception, may now plague the hypnotized for a long time, for he has not carried out the suggestion; but this is by no means always true. It often passes, and everything is over. If I say to a still more suggestible hypnotized, who has placed the chair upon the table: "After awaking, you will give Mr. X., who is now present, a kiss," or, "You will pour the contents of the inkstand upon your hand," or, "You will abstract the knife which lies upon the table and belongs to me; I will not see it; it is true, it is a small theft, but that does not matter"—the matter will run a different course. A violent struggle will arise between the force of the suggestion on the one hand, and the associated æsthetic or ethical contra-conceptions of the normal individuality, *i.e.*,

of the inherited and acquired cerebral dynamisms, on the other hand. This struggle will be so much more violent the more powerfully these contra-conceptions and the suggestibility are developed. The stronger the antagonistic forces, the more violent will the struggle be. Its termination will depend upon the intensity and the endurance of each of these forces. We must take into consideration here the individual components of which each of these antagonistic power consists. They are:

1. The height of the individual suggestibility.
2. The duration of the action of a suggestion in the brain of the hypnotized.
3. The strength of the hypnotic education or training.
4. The profoundness of the sleep (which, by dissociation, enfeebles the resisting power of the normal mind and comes into question particularly in activities during the hypnosis itself).
5. The adequate, *i.e.*, the desired action of a skilful and vigorously adapted suggestion, *i.e.*, of the psychical action of the hypnotizer.
6. The normal individuality of the hypnotized, *i.e.*, the development of his ethical and æsthetical disposition, his power of will, his education, etc.
7. The momentary psychical condition of the hypnotized, etc.

Point 6 is extremely important. Whoever possesses but little conscience will, other things being equal, follow out a criminal suggestion much more readily than one in the possession of a strongly developed conscience.

Point 4 also holds good, according to our former statements, for post-hypnotic conditions, in so far as these bear more or less the character of a renewed hypnosis. The more completely awake the hypnotized is the better he can struggle against a suggestion.

We see how complicated the problem is, and we have to deal chiefly with the question: "How far can it go?"

It has been seen that even during profound hypnotic sleep a struggle may occur between the suggestion and the individuality of the hypnotized. Not every suggestion is accepted, as Bernheim has clearly shown. Even when a criminal suggestion is accepted, it usually leaves behind the traces of a profoundly associated emotional disturbance.

To a man of 70 years whom I had placed in profound sleep, and who sat in a room in the presence of the Zurich Legal Society, I said: "Directly in front of us is a bad fellow, a scalawag; we will murder him; there is a knife (I place a piece of chalk in his hand). He is standing directly in front of you; stab him in the abdomen." Manifesting great internal excitement, trembling, with distorted features, he grasps the chalk spasmodically in his right hand, suddenly rises, and stabs violently with great force into the air twice in succession. Afterward, he remained very excited during the hypnosis; does not return the chalk, but puts it in his pocket. Several minutes elapse before I can quiet him by suggestion. When I then awake him, he is still perspiring and excited; he can no longer remember what has happened, but says that something must have gone wrong.

Bernheim, Liégeois, and other French writers mention extremely interesting cases of, in part, quietly executed criminal suggestions of (apparent) murders, of suggested actual robbery, etc. By suggestion I have also induced a man to shoot (with a revolver loaded with blank cartridges) a student. I also induced a nurse to slap vigorously the same individual, and another honest girl to steal a 50-centime coin.

The fact remains patent that a somnambulist may commit grave crimes by suggestion during hypnotic sleep, and at times may know nothing of this subsequently. The best proof that somnambulists consider the actions which they perform post-hypnotically as willed freely by themselves, resides in the manner in which they are ashamed, and often attempt to conceal them. I allowed a hypnotized who was quite feebly developed ethically, to steal a knife from the table post-hypnotically. After she had left the room, she went in a shamefaced way to my cook, told her that by mistake she had taken a knife, she did not know how, and begged of her to restore it without telling me, "because she was ashamed of herself." One of the most cunning knaveries of suggestion consists in the utilization of the suggestions à échéance together with the suggestion of amnesia and of a free effort of the will, in order to induce an individual to perform an action for a selfish purpose or to commit a crime. He then finds himself in a condition which must simulate spontaneity to him and all others, and yet he acts only at the command of another. We

can imagine how, in this way, love and marriage may be suggested to a rich heiress, how a will in favor of this one, or, on the other hand, disinheritance, may be suggested. We can understand that an individual may carry out plans of revenge, robbery, etc., by the abuse of a hypnotized by means of suggestion à échéance. It is true, that this requires individuals of feeble character with somewhat blunted feelings and easily suggestible natures, in whom the criminal originator would first suggest the necessary preliminary feelings by means of which they would soon obtain the conviction that they had acted spontaneously. This holds true concerning the suggestion of suicide.

Formerly it was often observed that the hypnotized were afraid of their hypnotizer; concealed themselves from him as if from an evil spirit. This was due to the fact that the "magnetizers" of that time did not understand the psychological sense of their own art and effected the hypnosis by means of all sorts of mystical hocus pocus. In Liébault's method hypnosis is effected by the aid of quiet, natural, friendly words. The hypnotizer no longer appears as a Mephistopheles, but as the healing physician, or, at least, as the trust-awakening man of science, who employs only natural means. Moreover, he is able by suggestion to make hypnosis desirable to the hypnotized. He can suggest to him a feeling of well-being, cheerfulness, sleep, appetite. This explains the fact that such hypnotized individuals in great part return very readily, and regard the hypnotizer as a friend; but herein resides one of the greatest criminal dangers of suggestion. Flies are caught with honey, not with vinegar. It is not only a matter of yesterday, as we have seen, that certain siren-like individuals possess the gift of converting others into the blind tools of their egoistic purposes. In future, however, much more will undoubtedly be obtained in this direction by well-directed suggestion.

On the other hand, a new knowledge always brings the antidote with it. Men are thus warned against the danger of suggestion by bad people. The judge will learn to consider the psychological significance of the entire series of facts. Finally, a very suggestible person who is suggested in a favorable manner by a trustworthy physician before witnesses can thus acquire a considerable, although not absolute protec-

tion against bad suggestions. This protection will be won by suggestions of strength of will, of struggles against bad influences, etc. But above all, we will tell the hypnotized: "I alone and no one else can hypnotize you." To an extremely suggestible, very profoundly sleeping nurse who wished to journey to her bridegroom in America I gave this suggestion because she feared to be abused upon the journey. It was easy here to note the result, because other expert persons have since vainly endeavored to hypnotize her. In order to effect this, I gave her my photograph as an amulet, with the suggestion that if she should again suffer in America from her rheumatic and other complaints, she need only regard the picture for a moment; she would then fall asleep for a quarter of an hour, and on awaking the symptoms would be lost. Even before the trip I allowed her to make a test of the fifteen minutes' hypnosis with the photograph.

Unfortunately, a criminal may employ similar measures, and suggest to the hypnotized, "I alone can make you fall asleep, and then you will no longer know that you were hypnotized." By means of experiments which Liégeois carried out in common with Bernheim and Liébault, he showed that a hypnotized to whom a criminal had shrewdly suggested amnesia and spontaneous resolution, etc., of the suggested crime, could yet be brought to reveal the evil-doer in an indirect way by the suggestion of apparent protection against the criminal, etc. However, he seems to assume that we can rehypnotize the somnambulist; that the evil-doer cannot successfully offer the suggestion that no one else can again hypnotize him.

I believe, however, with Liégeois, that the final discovery of the true criminal by persistent hypnosis of the somnambulist by an expert hypnotizer will succeed almost always, if not always.

This does not exclude, however, the possibility of crime. Criminals often commit their deeds without sufficient precautions, and hypnotism will exercise its attraction for the criminal because it offers him certainty of protection in the immediate future. In addition, we will not always think of hypnotism after a suggested, but apparently spontaneous act.

The further danger of hypnosis consists perhaps in the production of diseases. For evident reasons no experimental

proofs of this suspicion have been offered; yet this is undoubtedly possible, perhaps even easy. Hysterical attacks have been produced accidentally by poor methods of hypnotization. Even the Nancy method in the inexperienced hands of a tyro may produce disagreeable accidents. If the hypnotizer does not understand how to check a morbid symptom which develops perhaps during the first hypnosis (tremor, headache, and the like) by vigorous contra-suggestion, according to my experience, this is always possible. Such accidents can almost always be made good by an expert operator. But Liébault, and later, Bernheim, have pointed out that many peculiar phenomena, certain diseases, and even cases of death, which the individual in question had prophesied for a definite period, or which had been prophesied by fortune-tellers, depended perhaps upon auto-suggestion or suggestion. By means of auto-suggestion, a man who exhibits a tendency to hypochondria, may acquire anorexia, considerable emaciation, etc. Formerly, I have seen real diseases followed by cachexia lasting months, and even years, whose development I now think may be attributed to auto-suggestion of the patient, and its further development by suggestion on the part of the equally deceived physician. In one case (doubtful ulcer of the stomach without hemorrhage) my view was confirmed by the extreme suggestibility of the patient as observed by me at a later period. If we remember that by means of suggestion we can produce or prevent a process such as menstruation (recently I have experimentally delayed menstruation for two full weeks), there can be no doubt that disease, and, indirectly, death, may be produced by suggestion in a criminal way. If it were possible to suggest paralysis of the heart, for example, or œdema of the glottis, the possibility of a direct suggestion of death would be given. As we have seen, suggestion *per se*, when cautiously employed in the proper manner, according to the Nancy method, is attended with no disadvantages, neither hysteria nor nervousness. And if it produces a disagreeable symptom, such, for example, as spontaneous somnambulism, a contra-suggestion suffices to relieve this. In the 250 individuals whom I have hitherto hypnotized I have never observed an injurious effect (apart from the auto-suggestion of headache, etc., which ordinarily occurs only after the first hypnosis and which is at once suggested away); but if suggestion is em-

ployed frivolously and excessively, if from carelessness or ignorance we fail to relieve at once the above-mentioned auto-suggestions of nervous symptoms, neuroses may develop without any intention on the part of the hypnotizer. Herein lies the main danger of hypnotization by the laity.

One of the most peculiar, and at the same time, most important, if not the most important, criminal meanings of suggestion resides in the deception of memory, the retroactive hallucination, called forth unconsciously, *i.e.*, suggested to an accused person by a criminal judge. We have already discussed this phenomenon. In attempting to obtain from a child, a woman, or a weak man, by the use of great persuasive power, a confession of a deed of which he is suspected, we can suddenly produce the suggestion that the innocent victim is the criminal. If this is the case, there follows not alone a complete confession of the deed which was not performed, but, in addition, every possible detail of the most complete character is hallucinated retroactively. These very details will best inform us that we have to deal with a suggested deception of memory, that is, when they do not coincide with what has been ascertained positively concerning the deed. An easy and very valuable control experiment, when this suspicion is entertained, consists in suggesting to the accused details concerning which we are certain that they could not possibly have occurred. If he admits all these we can be tolerably certain that the entire confession is worthless or dependent upon suggestion by the judge. In this way we can prevent the murders of justice. We have also seen that certain well-known instinctive liars are nothing more than individuals of such a susceptible character that they constantly mistake their own conceptions and those conveyed to them by others for reality. We find this peculiarity existing quite generally in many savage races, especially in the Orient, and in negroes, not to speak of the countryman of Alphonse Daudet's notorious "*Tartarin de Tarascon*."

Not alone false confessions, but even false witnesses can be prepared in this manner, and by the terrifying procedures to which witnesses are often subjected. In the method in which they are plagued by lawyers they will certainly often be led to make statements which depend upon suggestion. Contradictions which are held up against them are not always con-

scious lies, but not infrequently suggested actions. Children are especially dangerous in this respect, the more so the younger they are.

We must here distinguish two cases: 1st, the case in which suggestion is produced by the special action of the examining advocate in an individual who otherwise is tolerably truthful; second, the case in which the witness always confuses truth and the products of his fancy, because he can do no other.

The second case has long been known under another name, and is less important. We soon recognize the character of such witnesses by their conduct and by other testimony, or we learn it by their reputation. We regard them as habitual liars and attribute no importance to their statements. The first case, on the other hand, must be a source of much thought to the criminalist, because it may occur in really good people who in all other respects depose to the truth and have received a false memory only by suggestion.

Is a hypnotized individual to be considered unconditionally as irresponsible? This question must be considered in the concrete case as extremely difficult. It is true that, as almost all authors, including Lilienthal, believe, every individual who acts under the effect of a suggestion must be regarded as irresponsible. The hypnotizer who utilizes him is responsible for his action. But how can we carry this out in practice when we remember the frequency of unconscious suggestions, not recognized as such, which occur everywhere in the world without palpable hypnosis, and how will we define the boundary of responsibility in the fine shades of waking suggestion which we described above? *Natura non facit saltum*. Here this old truth also holds good, and stamps as wrong our artificial categories as it does in mental diseases.

From a practical standpoint, I must again warn expressly against the distinction between lethargy and somnambulism made by Von Lilienthal. These conditions are only apparently different. The somnambulist can be abused sexually with as great certainty as an apparently lethargic individual. There are merely differences in the variety of the suggestions. In my opinion both must be placed on the same plane in a forensic sense.

As the writers have shown, the great danger of suggestion consists in its utilization on the part of the hypnotized for

blackmail of every kind. This danger is so great that the presence of witnesses for the protection of the hypnotizer is still more necessary for him than for the hypnotized. I refer the reader to Von Lilienthal's work and also to the case in which an individual allows himself to be hypnotized intentionally in order that by suggestion he may receive courage for a crime. (How many screw up their courage by drink?) It is hardly necessary to add that I agree entirely with Lilienthal and Rieger that public exhibitions of hypnotized somnambulists should be strictly prohibited as gross breaches against public morals and health. Such exhibitions can be compared only with those of lunatics or physiological experiments. It seems to me that the mercenary use of hypnosis in general should be prohibited.

Finally, it seems to me that the results of careless or frivolous use of suggestion, especially its use for egoistic or criminal purposes, should not be left out of consideration by jurisprudence. Must I, in conclusion, reply to Rieger, that he is entirely wrong when he believes that hypnotism can be repressed by the police and will soon disappear, like Mesmer's frauds? I hardly believe that this is necessary. Every one will see that the discredit into which Mesmerism fell was due to the vague theories of Mesmer, its charlatanism, and its times.

The child was poured out with the water, but did not die. It now appears in its true shape, free from nonsense, mysticism and mercenary motives in the light of the newer psychology. It is now too late to hide our head in the sand, like the ostrich, or to call upon the police for help. We must to-day look at these phenomena, which are so terrifying to many people, with clear consciousness and without dread. We must subject it to the strictest scientific investigation and utilize it for the benefit of humanity, instead of its injury. We will assimilate this, like all other natural phenomena.

The discovery of the psychological significance of suggestion by Braid (imperfectly) and Liébault, is, in my opinion, so great that it may be compared with the greatest discoveries of the human mind. With the majority of them it possesses this feature in common: that the facts are not new, but have hitherto been misunderstood in their real significance. I mention, for the sake of comparison, Darwin's theory of

evolution, the discovery of antiseptis, and the utilization of electricity. To Braid and Liébault we owe the discovery of the nature of hypnotism and suggestion. To Bernheim belongs undoubtedly the merit of making this truth recognized generally by the clearness of his presentation, and by the addition of many facts. Among others who have rendered services in certain points of detail, we may mention principally Faria, Puysegur, and Durand Degros. But no one has advanced our knowledge of the nature of the phenomena to such an extent as the first-mentioned writers.

THE FORMS OF
NASAL OBSTRUCTION

IN RELATION TO

THROAT AND EAR DISEASES.

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THE FORMS OF NASAL OBSTRUCTION.

CHAPTER I.

IN these days of multiplication of text-books, the lecturer finds it unprofitable to himself, and wasted time to his hearers, if he treat of the subjects systematically arranged therein. I do not, therefore, propose to take you over the whole field indicated by the title I have chosen for these three Lectures, seeing that you can traverse it for yourselves better than I could lead you. Indeed, I intend discussing only the commonest forms of nasal obstruction, and solely as they appear to myself. But, nevertheless, although I say the diseases of which I shall treat are of common enough occurrence, yet some at least of them have been but inadequately described, while their pathology is often totally misunderstood. And it is my hope that I shall, if not elucidate these myself, at any rate help you to investigate them for yourselves.

Briefly, the affections to which I wish to draw your attention are these:

- I. Obstructions the obvious consequence of chronic rhinitis; which may be further divided into—
 - (a) Chronic catarrhal rhinitis with vascular tumefaction;
 - (b) Chronic catarrhal rhinitis with hyperplasia; this leading in its turn to—
 - (i.) Dry hyperplastic rhinitis;
 - (ii.) Dry atrophic rhinitis.
- II. Obstructions arising from mucous polypi and cysts.
- III. Obstructions arising from post-nasal neoplasms.

These divisions are purely artificial, seeing that no line of demarcation can be drawn between them. Nevertheless, as you will see, they are rational, and will be of assistance pathologically as well as therapeutically.

The consideration of these various forms of obstruction will involve the investigation of symptoms referred to more remote structures than the nasal mucous membrane; and we shall inevitably find ourselves discussing diseases which at present you may suppose to be apart from the domain of nasal pathology—and this, although I do not consider it necessary to do more than refer in the briefest manner to the various so-called nasal neuroses.

Before I describe *seriatim* the diseases I have mentioned, I propose enumerating the various symptoms, subjective and objective, of nasal obstruction, from whatever cause arising. And before these can be satisfactorily discussed, I must give you an idea of the normal appearances of the nasal fossæ, as revealed by anterior and posterior rhinoscopy. This I must trouble you with, seeing that some otherwise trustworthy text-books give but imperfect, and sometimes actually erroneous, descriptions of the normal appearances; and believing as I do that no class of speculum-observation needs so much practice and patience before it can be employed with satisfaction to ourselves and benefit to our patients.

The apparatus needed for anterior rhinoscopy is simple enough. A good light from a laryngeal reflector, a nasal speculum, and one or two probes, are all that is needed. The form of speculum is not of much consequence, provided the blades are not fenestrated; otherwise small hairs in the vestibule obstruct the view. Thudichum's instrument in two or three sizes serves all purposes, and is self-retaining.

Well, then, having dilated the nostril and illuminated the interior, what do we see? Presuming the head to be sufficiently tilted back to afford the best view, and the projecting hairs held on one side by the blades of the speculum, we see for a greater or less distance into the nasal fossa. In the lower part we observe standing out from the external wall the inferior turbinate body, a fold of mucous membrane covering the inferior spongy bone, and including a plexiform arrangement of veins to which the erectile property of the structure is due. This erectile tissue extends along the free border

of the turbinate body, being specially developed at the anterior and posterior extremities. According to the degree of turgidity we can see to a greater or less distance along the inferior meatus; but frequently the swelling is so great, although scarcely to be considered pathological, that this channel is completely blocked. After exposure to cold air, and during an attack of acute coryza, the inferior turbinate body becomes greatly swollen and darker in color than the usually bright red of its mucous membrane, a point to which I shall have to refer again in speaking of the functions of the nose in relation to pathology. Yet although I say this turgidity is scarcely to be considered pathological, at any rate anatomically it frequently comes under observation as a form of nasal obstruction and as such requires definite treatment.

If we investigate with a probe the nature of the inferior turbinate body when in a state of turgidity, we observe that with this instrument it gives the sensation of a bag loosely filled with fluid. Indeed it fluctuates; and on a first examination one can hardly be persuaded that it does not contain fluid other than the blood of its erectile structure. But the application of a twenty-per-cent solution of cocaine quickly restores it to its normal condition, and the true nature of the swollen tissue is revealed.

Besides that on the inferior spongy bone, there is another mass of erectile tissue on the septum, a little lower than opposite the anterior third of the middle turbinated bone. This is as liable as the inferior turbinate body to erection, although its smaller bulk renders it less conspicuous. But the appreciation of its real character is quite as important, seeing that not infrequently its turgidity leads to the supposition that the middle turbinate body is in contact with the septum, whereas the erectile tissue merely conceals the slit which normally exists between the convex margin of the middle turbinate and the inner wall. The middle spongy bone has also a small amount of erectile tissue along its free margin. (Bigelow, "Boston Medical and Surgical Journal," April, 1885.)

And now we must consider more particularly this middle turbinated bone and its coverings, which are so much misunderstood in their physiology and pathology, not to speak of their normal appearances; and the diseases of which are so numerous, and have given rise to so much dispute, that I trust

you will pardon me if I seem to trespass unduly on your time with minutiae on this head.

According to the degree of prominence in the inferior turbinate body, we see more or less of the free convex border of the middle spongy bone, between which and the septum there is a clear passage, although this may be obscured by the erectile tissue on the septum which I have mentioned. This, I say, is important to bear in mind, seeing that in certain inflammatory conditions the middle turbinated tissue is found in contact with the septum, and the physiological may be mistaken for the pathological, or vice versâ. Then, between the free margin of the bone, curved inward on itself, and the outer wall of the fossa, is a deep sulcus, corresponding with the concavity of the spongy bone, so that the free margin appears to hang downward from the roof. Once more we must observe and remember that between the anterior extremity of the middle spongy bones and the nasal bones there is a free passage, which, nevertheless, is considerably narrower in the living subject than in the skeleton. This passage also in pathological conditions is occasionally obstructed.

That portion of the fossa which lies below the upper margin of inferior spongy bone is commonly spoken of as the inferior meatus; into it opens the naso-lachrymal canal. Between the concavity of the middle turbinated bone and the convexity of the inferior extends the middle meatus, into which, an inch and a half or two inches from the orifice of the nose, opens the antrum, as well as higher and more anteriorly the frontal sinus with the anterior ethmoidal cells, through the semilunar opening into the infundibulum.

In by far the majority of individuals we find more or less deflection of the septum, with the greater or less development of bony ridges running from before backward. The most frequent site of the deviation is at the junction of the vomer with the perpendicular plate of the ethmoid and the triangular septum. This malformation, which it must be considered, although the rule rather than the exception, chiefly interests us at this stage of examination because of the difficulty it causes in examining properly the side encroached upon. Deviation of the septum may be readily diagnosed from ecchondrosis of the septum by the corresponding depression in the opposite fossa.

So much for what is seen by anterior rhinoscopy.

Posterior rhinoscopy is at once more difficult and easier than anterior. As you well know, it is effected by manipulation of the laryngeal mirror directed upward behind the soft palate. The difficulty consists in placing the mirror in position; but that effected, the structures brought into view are easy enough of comprehension.

In ordinary cases all that is needed is a small laryngeal mirror, with stem strong enough for the angle to serve as a tongue-depressor. For examining the septum, turbinated bodies, and vault, the angle of the mirror should be about a right angle, while for investigating the posterior naso-pharyngeal wall, the angle should be even wider than that of the laryngeal mirror. Sometimes it may be necessary to use a tongue-depressor as well. In either case we must insinuate the mirror behind the uvula without touching either it or the posterior wall of the pharynx. The advantage of dispensing with the tongue-depressor is that, with our left hand, we can steady the patient by holding his chin. But in every case we must persuade him that we are master of the situation. A patient knows who is examining him as well as a horse knows its rider, and he permits us to get a view or not, according to our manipulative dexterity. We must be at once firm and gentle for this sometimes exceedingly difficult operation. Often we may cause relaxation of the soft palate by requesting the patient to breathe through his nose; more often, however, he only closes his mouth. But the longer we take to get a view, the more difficult does it become. Sometimes we may need the application of a ten-per-cent solution of cocaine, in conditions of great irritability; and sometimes we may be helped by one of the many forms of palate-hook, in conjunction with cocaine. Of course we should aim in this, as in all surgical manipulations, at effecting our end with the simplest means and least display of apparatus.

Well, then, having the angle of the mirror pressing on the back of the tongue, and the upper edge of the reflecting surface just below and well behind the margin of the pendulous palate, we have our view of the post-nasal structures, a view, however, pieced together by a series of altered inclinations of the mirror. We see the two choanæ separated by the vertical, in this situation very rarely deflected, septum. Into these

project almost horizontally the three, sometimes four, turbinated bodies with their intervening channels. The inferior meatus, owing to the prominence of what is called the uvula-cushion, frequently appears as no more than a narrow slit, while often the whole of the inferior turbinated body is hidden. The middle meatus is not infrequently contracted by congestion of the erectile tissue covering the bone below, while the superior meatus may appear to possess an unwarranted importance, seeing that it is only posteriorly that it is fully developed.

Externally to the choanæ we see the yellowish opening of the Eustachian tube, with the salpingo-palatine fold in front and the salpingo-pharyngeal fold behind. Externally to this again is Rosenmüller's fossa, into which the Eustachian catheter sometimes inadvertently passes. In the another part of the vault we may, or may not, distinguish the raised collection of lymphoid tissue described as Luschka's tonsil, in the centre of which a depression may sometimes be seen. Running downward from this are not infrequently seen two adjacent folds of mucous membrane, one on each side of the central raphe. These and Luschka's tonsil, otherwise called the pharyngeal bursa, have lately given rise to much speculation and divergence of opinion, of no practical and not much other value. (*"Journal of Laryngology,"* February, 1887. Art. "The Pharyngeal Bursa.")

Now I have only a word to say concerning the normal color of the nasal and naso-pharyngeal mucous membrane—a matter not very easy to determine in a city like this, where nearly every one suffers from more or less nasal catarrh. In front the darkest portion is the inferior turbinated body, the middle being much paler. Posteriorly the structures projecting into the choanæ are usually a pale gray in color, while the mucous membrane of the naso-pharynx in general may be described as pinkish gray.

And now before considering the various affections which give rise to nasal obstruction, I will recount to you some of the more obvious symptoms, principally subjective, for which the patient seeks relief; and I shall refer to certain points in the physiology of nasal respiration explanatory of one or two objective signs which nevertheless are not dependent for their discovery upon instrumental examination.

As one would naturally suppose, the patient frequently complains of his nose being stopped up; yet he frequently denies any obstruction to his breathing, although he may actually be suffering from very grave interference with that function. In the former case the obstruction is more or less complete, while in the latter it is only partial. When complete obstruction exists, the sufferer complains of difficulty in breathing; this he experiences especially on taking any extra exertion and during sleep, when he not only snores, from the air impinging through the mouth on the lax velum and causing it to vibrate, but he may tell you he often wakes up struggling for his breath. Sometimes, indeed, the patient is supposed to be asthmatic, as indeed he may be, though the cause is nasal obstruction. Then he may complain of dizziness, loss of memory, inaptitude for mental exertion, symptoms to be referred more properly to the anæmia resulting from interference with respiration than from direct or reflex irritation as some imaginative observers maintain. Occasionally the sufferer will assert that there is something flapping in his throat or nose, and the noise may even be audible to a bystander, a phenomenon which obtains when a pedunculated polypus or flap of hypertrophied mucous membrane is the cause of obstruction. Another symptom observable to the patient's friends, and for which he is peculiarly hated by his enemies, is a perpetual sniffing varied by frequent and unsatisfactory attempts at blowing his nose. The nasal flux may be so excessive that the patient's pillow is stained with it; he may have frequent attacks of sneezing specially aggravated the first thing in the morning. Then his speech is thick and guttural from a semi-paretic condition of the palate—his voice is nasal, in common parlance—and he experiences difficulty in chewing and swallowing. In the case of polypi the symptoms are all more or less aggravated during damp weather. A patient of mine lately came one morning drenched by a passing shower. He inconsiderately attributed the blame to me, saying I had utterly ruined his aneroid on which he had learned to be so dependent, in that I had removed some enormous nasal polypi! But since he had been told two or three months previously by a physician of repute that he had incipient softening of the brain, his symptoms being headache, anxiety, impaired memory, difficulty in speech, and general

feebleness; and since all of these had been greatly relieved by restoring nasal respiration, his complaints were in the nature of gratitude rather than of aught else!

The sense of smell is of course interfered with, and this although taste may be almost or quite normal. The reason of this is obvious when we consider the course of the inspired and the expired air-currents. Even in the healthy condition, probably very little of the inspired air reaches so far back as the bulk of the superior turbinated bone, while when the upper channels of the nose are obstructed none can pass in that direction. But on the contrary, the expired air, which during mastication is laden with odoriferous particles, is driven by the thorax directly upward to the vault of the naso-pharynx and readily comes in contact with the projecting superior turbinated bone, over which is distributed the posterior division of the olfactory nerve. Indeed it would not be incorrect to style the superior spongy bone the organ of taste, the middle turbinated and plain surface of the ethmoid that of smell. Of course, we may have polypi obstructing access to the superior spongy bone; but it is not common, obstructions for the most part being confined to the region of the middle and inferior turbinated bone.

Among the far-reaching consequences of nasal obstruction we must mention the occurrence of pigeon-breast, which in its relation to enlarged tonsils was first pointed out by Dupuytren. Indeed, when we meet such grave disturbances as this simply as the consequence of nasal obstruction, we cannot fail to be impressed with the importance of the nasal functions, although it is difficult to perceive from mechanical considerations why respiration should not be even easier through the mouth. Probably enough, contraction of the bronchial tubes is a physiological regulating valve for the prevention of improperly prepared air gaining access to the pulmonary vesicles, and for enforcing nasal respiration. Indeed we never see asthmatics with open mouth, but with dilated nostrils. Breathing, they will tell you, is so much easier through the nose. I had a patient lately in the hospital suffering from laryngeal stenosis. He could breathe fairly comfortably when his nasal passages were free; but when from any cause they became obstructed he was seized with stridor. He could even produce the stridor at will by holding his nose and adopting buccal

respiration. The case suggests very strongly the importance of a healthy nose for the mechanical welfare of the larynx.

Then, again, we must accept as fact the not infrequent cure of spasmodic asthma by the removal of nasal polypi. One reads of even more serious diseases, such as epilepsy, being caused by such interference with respiration; and I imagine they can all be explained on the mechanical theory, without having recourse to the elaborate and conflicting observations and opinions of our Continental confrères. But I do not in this place intend referring to the so-called nasal neuroses, seeing that they have not fallen under my observation.

Continuing the enumeration of possible consequences of nasal obstruction, we must not forget epiphora or lachrymal abscess as the result of pressure on the nasal duct.

Whether Eustachian deafness can be considered as a direct consequence of nasal stenosis, or rather as an extension of a catarrhal process, may be open to discussion. Some authorities hold that the tube is permanently open, and that fresh air enters the tympanum by diffusion at every inspiration. This is too large a physiological question to discuss at present, and I will be content with mentioning two practical points: first, that there is no manner of doubt that post-nasal growths cause direct occlusion of the Eustachian tube; and second, that whatever the physiological facts, restoration of the nasal functions frequently leads the way to the permanent cure of Eustachian and middle-ear catarrh.

I have now mentioned the principal subjective and functional symptoms arising from any form of nasal obstruction. But with those objective symptoms of which I intend speaking now, I must be more precise as to the exact seat of the obstructions which give rise to them.

And first I will inform you of certain appearances to which sufficient attention has not hitherto been paid, and which are due to obstructions arising in connection with the middle turbinated bone. The first is a physiognomical and the second a pharyngeal sign, often, though not necessarily, associated with one another.

Whenever the middle and upper channels of the nose have been obstructed for some time (I cannot speak more definitely), whether from the presence of polypi, or from hyperplasia of the mucous membrane covering the middle spongy bones, in

which state the whole of the middle meatus may be blocked up and the passage into the superior channel obstructed, we find a peculiar expression of the face which to me is almost, if not quite, pathognomonic of the obstruction in question. Briefly it consists in this—elevation and eversion of the upper lip, the alæ of the nose being at the same time raised at their junction with the cheeks, this point being also apparently more sunken than usual; as well as a deep furrow running downward from the nostrils toward the angle of the mouth.

Now this appearance is not to be confounded with the type of face so commonly met with in strumous children, which it somewhat resembles, which moreover is frequently found in connection with the various forms of chronic rhinitis; for we find the appearance of which I speak developing in after-life, when it is clearly the result of an adventitious nasal obstruction. The thick everted lips of the strumous child, the sunken alæ, the prominent cheeks, with the depressed point of origin of the nose from the forehead, and the nostrils directed slightly forward, form a distinct and unmistakable picture.

But to what is due this expression which I have said is almost pathognomonic of obstruction in the middle meatus? To answer this question we must for a minute consider, step by step, the course normally pursued by the indrawn current of air.

The expansion of the lungs causes a rush of air vertically downward from the naso-pharynx. This current, from the direction of the epiglottis backward and upward, must necessarily sweep over the posterior and lateral walls of the naso-pharynx, and leave a vacuum in the highest as well as the lowest regions. The vacuum is immediately filled by air passing along the various channels of the nose, which incline slightly downward as they pass backward. This movement in its turn causes the external atmosphere to pass more or less directly upward, as well as backward, through the nostrils.

Now the external orifice of the nostrils is placed at a lower level by a quarter of an inch or more than the entrance to the floor of the nose, an arrangement which obviously gives the indrawn current of air an upward direction, instead of allowing it to pass directly backward through the inferior meatus. This is a fact which may be submitted to the simplest experiment. If with an odoriferous substance beneath the nose we

inhale its particles, first with the nostrils merely distended, and secondly with the alæ raised, we find that the olfactory region is far more stimulated in the former than in the latter case; the explanation obviously being that when the orifice of the nostril is raised on to a level with the entrance to the inferior meatus, the air passes more readily backward than upward, and so avoids the olfactory mucous membrane. Indeed, in the presence, say, of bisulphide of carbon, we instinctively raise the alæ, or, as we say, turn up the nose; while on the contrary, when anxious to abstract the full quatum of sweetness from a rose, we merely dilate our nostrils, and perhaps even depress them. Or again, when we wish to express our contempt for a professional brother, we raise one ala only, by which, in a very delicate manner, we tacitly insinuate that we do not like the smell of him!

The pathological expression under discussion, indeed, we may call briefly a slight turning up of the nose. Respiration being obstructed through the middle and superior channels, an effort is made to facilitate the passage of air through the inferior meatus by bringing the external opening of the nostrils more on a level with the osseous entrance to the floor of the nose. The muscle by which this compensatory movement is effected is the levator labii superioris alæque nasi, which not only raises the ala and upper lip, but also slightly everts the latter, seeing that its fasciculi are inserted in the lip superficially to the bulk of the orbicularis oris. And it is by a persistent shortening of this muscle that the permanent expression indicative of obstruction in the middle meatus is produced. But remark, that although in this peculiar physiology the mouth is kept slightly open by elevation of the upper lip, yet the respiration is obviously nasal and not buccal. The latter I shall consider presently, when I have discussed the other objective sign in connection with obstruction of the middle meatus, for which, as I said, we must look in the pharynx.

Briefly, it is a dried, shrivelled appearance of the mucous membrane on the posterior wall of the pharynx. I emphasize "appearance" advisedly. For if we pass a piece of cotton wool over the surface in question, a thin film of inspissated mucus will peel off, leaving the membrane beneath in its naturally moist condition, granular, atrophied, or hypertrophied, as the case may be.

Now this so-called pharyngitis sicca is, in a large number of cases, symptomatic of swelling of the middle turbinated tissue and obstruction of the middle meatus; and it results, as appears to me, from the inspired air, instead of circulating among all the moistening interstices of the nose, passing directly backward along the inferior meatus and impinging on the posterior naso-pharyngeal wall in an abnormally dry condition. And not only this: but just as a river flows more rapidly as its channel narrows, so does the inspiratory current pass along the inferior meatus with an abnormal velocity, and striking on the first moist surface it meets with unusual momentum, it rapidly dries it, and leaves the film of dried mucus. This dry appearance, in fact, is confined to the posterior wall: we never find the pillars or palate sharing in the trouble; and when swelling of the middle turbinated tissue is the cause of it, we see that the dryness, on examining with the post-rhinal mirror, affects the mucous membrane opposite the opening of the inferior meatus, extending from that point downward.

In passing, I must remind you that pharyngitis sicca is in the text-books, if not described as an affection *sui generis*, then spoken of as an accompaniment of atrophic or granular pharyngitis. But when you have met with it a few times you will be convinced, seeing it even in the so-called hypertrophic conditions, that it is, in a large proportion of cases, really a symptom of nasal obstruction.

But we do not find pharyngitis sicca invariably when we have the peculiar physiognomy which I have just described. The latter may be due to the presence of polypi, which always excite a watery catarrh, in itself more than sufficient to prevent any drying of mucus; or we may find the obstruction as part of a catarrhal rhinitis, which also prevents the development of the symptom. On the other hand, the pharyngitis sicca may be but part of a rhinitis sicca, in the early stages of which we have indeed great inflammatory thickening of the middle turbinated tissue, although in the later stages the spongy bones themselves have all but disappeared. But although in the latter case we may succeed in restoring the normal secretion—a result, by the way, very seldom attained—yet the inspired air still reaches the pharyngeal wall unmoistened from the abolition of the turbinated bodies and their functions, and we still have our pharyngitis sicca. However,

in spite of all these qualifications, I advise you, whenever you see a pharynx with a tendency to dryness, to examine the condition of the middle turbinated bodies; for their swelling is often the sole cause of the dryness in the throat of which the patient complains; and by the knowledge of the pathology we may cure our patient. Nor is this all. We never find this pharyngitis sicca without more or less chronic laryngitis; and I think I may even say that we never find obstruction of the middle meatus, whether the posterior pharyngeal wall be dry or not, without a certain amount of laryngeal irritation, and that sometimes of a very serious nature. Those of you who have attended my clinic have seen several cases where the aphonia for which the patient sought relief has succumbed only by treating the nasal abnormalities. And when we remember that the nose has the definite function of moistening, warming, and filtering the inspired air, it only stands to reason that, if this function be abolished, the first structures which the inspired air meets will suffer. So that in every case of chronic laryngitis, we must examine the condition of the nasal mucous membrane.

And now for a word on the true buccal respiration and allied symptoms. They are met with chiefly in children the subjects of post-nasal neoplasms and enlarged tonsils, who are brought to us generally with the complaint of deafness. Sometimes the buccal respiration is caused by persistent tumefaction of the inferior turbinated bodies, a condition also occasionally met with in children; while less frequently polypi and deflection of the septum produce complete nasal obstruction.

In true buccal respiration the patients, chiefly from dropping of the lower jaw, but partly also from the frequently concurring deafness, have a singularly stupid appearance, and often actually lack the average intelligence of their age. This must be due in great measure to the general condition of faulty nutrition induced by imperfect preparation of the inspired oxygen for combustion to which I have already referred. For we must not forget that oxygen is as necessary to combustion as carbon; and that nasal obstruction is to the former element what œsophageal stricture would be to the latter.

But in connection with the nasal obstruction met with as the cause of buccal respiration there is another objective symptom which invariably accompanies the latter, and is

sometimes of great value in suggesting the course of investigation to be pursued even when the mouth is not habitually held open. I refer to a semi-collapsed condition of the alae, and more especially to a dimple on each side of the median line, nearer the point of the nose than the osseous framework. It is situated, I imagine, at the angle between the superior and inferior lateral cartilages, and is the point which, from lack of adequate support, most conspicuously reveals the abolition of function on the part of the special muscles of the nose. Briefly, the nose has in cases of buccal respiration a pinched appearance, almost pathognomonic. Yet occasionally an onlooker will remark rather the apparently great breadth of the bridge of the nose. But this is obviously only relative to the narrowness of the alar portion.

While still on the subject of the physiological consequences, if I may so style them, of nasal obstruction, I may advantageously refer to the function performed by the erectile tissue on the inferior turbinated bone. For the swelling of it, as I have already remarked, is a physiological phenomenon, and as such, we must suppose, performs a definite office. The passage from a warm to a cold atmosphere is sufficient to fill the plexuses with venous blood. If, as we have seen, swelling of the middle spongy body forces the air to traverse in preference the inferior meatus, correspondingly we must assume that obstruction in the latter will cause the indrawn current of air to circulate more freely among the higher tortuosities of the cavity, the purpose served obviously being a more thorough warming of the cold air.

There is one more objective symptom of nasal obstruction to which I will refer, namely an apparently paretic condition of the soft palate, which hangs down, away from the posterior wall, and responds but feebly to tactile stimulation. It is not by any means pathognomonic of obstruction, being frequently observed as an accompaniment of post-nasal catarrh. In fact it should be regarded as a concomitant of catarrh, rather than aught else; and its occurrence is sufficiently explained by the supposition that the muscular tissue is in a state of congestion no less than the overlying palatine glands. In dry rhinitis it is seldom observed, a fact which almost substantiates the hypothesis.

I will briefly recapitulate the symptoms of nasal obstruc-

tion, and then pass on to consider the different diseases which cause it.

The patient complains of stuffiness in his nose, chronic cold, and inability to clear his head, although he use his pocket-handkerchief constantly. He snores at night, his voice is unresonant and his gutturals blunted; he has difficulty in mastication and swallowing; he is possibly anæmic and otherwise badly nourished. Olfaction is more or less interfered with. He has a peculiar physiognomy, varying from a slight elevation of the upper lip and *alæ nasi* to complete buccal respiration with the pinched nose. He may suffer from a dry throat, and hoarseness or aphonia. He may have headache, asthma, and other nerve phenomena, or signs of obstruction of the naso-lachrymal canal. Finally, there may be no direct symptoms at all.

The forms of obstruction met with under the comprehensive term chronic rhinitis are numerous enough, although we may class them in two divisions—(1) obstruction arising from swelling of the inferior turbinated body, and (2) that originating in swelling or hyperplasia involving the middle spongy tissue. This division, although broad and rough, has yet a pathological value which we shall appreciate as we proceed. More accurately we may subdivide chronic rhinitis in the method I have already mentioned. Let me remind you:

- (a) Chronic catarrhal rhinitis with vascular tumefaction, which involves chiefly the inferior turbinated tissue;
- (b) Chronic catarrhal rhinitis with hyperplasia, involving chiefly the middle turbinated tissue.

This in its turn leads to—

- (i.) Dry hyperplastic rhinitis;
- (ii.) Dry atrophic rhinitis.

(a) Chronic catarrhal rhinitis with vascular tumefaction is one of the commonest affections met with. We see it passing through various stages, from the simplest persistent hyperæmia of the mucous membrane, to that form where all the special structures and functions of the nose are completely destroyed.

We find the affection for the most part in children of a strumous habit, perhaps less frequently in adults, and even more rarely in individuals past middle life. When I say it belongs to the strumous diathesis, that is almost equivalent to

ascribing it to the persistence of an acute catarrh, seeing that by struma we signify little more than an inability to recover from acute inflammation. We have all the signs of nasal obstruction in varying degree, buccal respiration, snoring, etc., being frequent in children, who are not uncommonly deaf from implication of the Eustachian tubes. In older patients, as well as deafness, there may be hissing tinnitus from the catarrhal condition having extended to the tympanum. There is usually, especially when obstruction is most marked, no great amount of secretion, although the child may be constantly picking his nose to remove the dried plugs which collect in the vestibule. Sometimes, however, there is a thin watery discharge. Occasionally the pocket-handkerchief will reveal streaks of blood, but there is seldom real epistaxis. So far the subjective symptoms are not different from those of post-nasal neoplasms and enlarged tonsils.

On examining the anterior nares with the speculum, we frequently see, especially in children, the inferior turbinated body altogether preventing any further view. Investigating the swelling with a probe it gives the sensation, as I have already remarked, of a bag loosely filled with fluid; while if we spray it with ten-per-cent solution of cocaine, the tumefaction subsides to a greater or less degree, and we may thus make a further examination. The swelling is moist, generally homogeneous, but sometimes granular, of a pale or dark-red color. In old-standing cases we may find hard papilloma-like bodies clustered anteriorly about the free margin of the body. The latter, also in old cases, may present a grayish-pink, translucent aspect, when it may readily be mistaken for a mucous polypus; but this is a variety not often met with. The tactile sensation is generally, but not always, diminished.

Examining the posterior extremity of the same body with the rhinal mirror, we discover swelling to as great or even a greater degree; but the appearance is more varied. The color is usually lighter than that of the anterior extremity, while it is sometimes a pale gray and quite polypoid in appearance. More rarely the color is dark-red or bluish. In any case the surface may be granular or lobular to a marked degree, and in the darker variety the appearance is generally and very correctly styled mulberry-like. Occasionally these dark-red lobulated bodies are of such size that they project into the

post-nasal space, conceal the septum by their approximation, and even obscure the choanæ altogether. If we make a digital examination by passing the forefinger behind the soft palate, so unsubstantial do we find them to be that we can feel nothing but the hard posterior extremity of the bone; while if, by the help of the finger in the naso-pharynx, we endeavor to slip over them a stiff wire snare passed through the anterior nares, we make the astonishing discovery that there is nothing to bring away. Nevertheless, the operation is frequently effectual in removing the obstruction although there is nothing to show for it; and we are driven to the conclusion that the tumefaction is possibly due to a high degree of œdema, or less likely to the development of cysts. I know of no microscopical researches into its true nature, the difficulties being sufficiently obvious.

The middle turbinated bodies also take part in the general tumefaction of the mucous membrane. But the development of erectile tissue in these situations being quite insignificant as compared with that on the inferior turbinate bones, we find their swelling under simple irritation much less pronounced, although sufficient to make them abut on the septum. The venous plexuses lying on the latter are also swollen, and the mucous membrane inflamed. The floor of the nose seldom presents any noteworthy changes, although small red elevations are sometimes observed anteriorly.

The course of chronic rhinitis is slow, and varies much with the state of the barometer, being troublesome when it falls, and vice versâ. The affection has little tendency to spontaneous cure, except in so far as improved general health will expedite recovery. The probable tendency of all cases is in the direction of hyperplastic rhinitis, with, ultimately, either the abolition of function as the natural consequence of excessive stimulation—that is to say, dry rhinitis, ozæna and atrophic changes; or with the development of polypi. Of the anatomical connection of these different states I shall speak when I discuss their pathology.

The only possibility of a mistake in diagnosis is to confound the simple vascular tumefaction with polypus, a blunder almost incredible to any one accustomed to a good light, a good speculum, and a handy probe; yet the error is frequently made. It is more excusable when the anterior swelling of the

inferior turbinate body is of long standing and has the grayish appearance I have mentioned. But even here the probe will remove all doubt; for the tumefaction, though perhaps seemingly movable and pitting under pressure, is fixed and not pedunculated. It may also help us to remember that polypi are rare in children, although the persistent and extreme tumefaction of the inferior turbinated tissue is fairly common. Lastly, this erectile tissue will subside under cocaine, which of course has no influence over polypi.

The prognosis is favorable, although the treatment is sometimes difficult. If the disease is left to itself it leads to such complications as deafness, from implication of the Eustachian tubes, probably post-nasal vegetations, arrest of development in the thorax, with the formation of pigeon-breast, as in the case of enlarged tonsils, and a general condition of malnutrition.

The treatment of simple chronic rhinitis consists in the first place in keeping the nose clean with alkaline or saline douches and placing the patient under the special hygienic conditions suitable to his constitution. He must avoid cold and damp, close rooms, and dust, sedentary occupations and over-fatigue.

While I attach a great importance to cleansing the nasal cavities, I must warn you against prescribing douches and sprays indiscriminately for every case. Where the flux is profuse there is no fear of accumulation of inspissated mucus; and we must remember that most chemical substances, even pure water, destroy the action of the cilia, and ultimately these bodies themselves; while the olfactory mucous membrane, though devoid of cilia, is even more susceptible to the action of such destructive agencies. The *lotio alkalina* of our *Pharmacopœia* is always very acceptable to patients; but I have failed to see any permanent benefits accruing from its use, although the out-patient assures us that it "clears his head beautiful." So I think it a pity to apply anything to the nasal mucous membrane that will not offer some hope of altering the morbid condition.

Very weak astringents, such as half a grain of alum to the ounce, applied through an atomizer, will sometimes effect a cure; or, on the contrary, in children we may paint the anterior extremity of the swollen inferior turbinate body with a strong astringent, such as glycerin of tannin, once in the

twenty-four hours with great benefit. The nasal bougies of our Pharmacopœia are sometimes serviceable. They dissolve slowly in the nasal cavities and bathe the mucous membrane with the drugs contained in them. Those of acetate of lead (gr. $\frac{1}{2}$), morphia (gr. $\frac{1}{10}$), or of bismuth, are particularly serviceable.

Where the vascular tumefaction persists in spite of such applications, we may sometimes gain much by the daily passage along the inferior meatus of a soft rubber bougie. The patient may even be taught to apply it himself. The largest size that can be comfortably passed should be retained for five minutes or so, and then a larger one substituted; and so on until the passage is comfortably free. We must remember that the normal width of the fossa varies much in different individuals.

Finally, in the way of radical cure, we may have recourse to linear cauterization of the swollen tissues with the galvano-cautery, or to a limited use of such caustics as chromic acid or London paste. If we desire to contract the tissue filling the concavity of the inferior turbinated bone, we may pass along it a probe covered with absorbent wool, saturated with a small quantity of chromic, glacial acetic, or nitric acids. The first of these appears to cause the least pain. Superfluous acid should be immediately removed by a piece of wool wrapped round a second probe. None of these operations give rise to much inconvenience, least of all the galvano-cautery. They will probably require repetition at intervals of a week or so for a few sittings, when a cure will be effected. If the catarrh is the most urgent symptom, it may be relieved by inhalations of creasote or cubebs, weak astringent sprays or morphia buginaria. In some cases I have found chromic acid ($\frac{1}{4}$ or $\frac{1}{2}$ grain to the ounce) very serviceable as a spray.

(b) And now we arrive at our next division of chronic rhinitis, namely, that which I have styled chronic catarrhal rhinitis with hyperplasia. It is a condition beyond that of simple chronic rhinitis with vascular tumefaction, intermediate between it and dry rhinitis on the one hand and polypus on the other. It is swelling especially over the middle turbinated bone, in which not only the erectile tissue is involved, although to a less degree, but real hyperplasia of the mucous membrane exists with cell-proliferation and its consequences. It is a

form of chronic rhinitis, while exceedingly common, yet frequently overlooked, and may exist almost per se, without much alteration in the other structures of the nose. Its symptoms are indefinite, and sometimes wanting, and seldom referred to the nose. But as I have already informed you, the patient may suffer (as, I may say, a physiological consequence) from laryngitis sicca and chronic laryngitis in every stage. The sense of smell is not as frequently vitiated as in the case of polypi, although it is always and inevitably more or less impaired. In minor cases there is but a slight swelling of the anterior third of the free margin of the middle spongy body, but sufficient to bring it in contact with the septum. In extreme cases we see in place of the middle turbinated body—the free margin of which should appear to hang down from the vault—the whole of the middle channel obstructed by a soft, scarcely movable swelling abutting on the septum, and reaching almost down to the inferior turbinated body; and between these two extremes there is every degree of variation. The affection is generally bilateral, although it is frequently more pronounced on one side than the other. Indeed, one may see the two sides of the nose in such different stages of what we must suppose to be essentially the same affection, that while one choana is crowded with polypi, the other is in a stage of incipient dry rhinitis, the channel in the middle turbinated bone being completely occluded with the tissue to which I refer. The posterior extremity may or may not be involved in the tumefaction.

While this hyperplastic rhinitis may undoubtedly be a further condition of simple chronic catarrh, yet the etiology of the two is not always the same; and we frequently find swelling of the middle turbinated tissue without any great amount of catarrh, and without any vascular tumefaction of the inferior turbinated body. While the latter is, I believe, always due to a persistent cold, so to speak, this hyperplastic swelling of the middle turbinated tissue is due frequently to contact of irritant particles contained in the inspired air. Granted that the current of the latter takes an upward as well as backward course, the first obstacle on which it impinges is the anterior third of the middle spongy bone, especially if the inferior turbinated body is in a condition of tumefaction. In fact, this anterior third is the very portion first

attacked; and sometimes, indeed, we find it covered with the dust to which the patient is exposed. The most extreme degree of this affection I have ever seen occurs in a case I will presently show you, although the patient's condition is now very different from what it was when she first came under treatment. Her work consists in preparing furs, and it exposes her to great quantities of dust. She came complaining of aphonia. She had chronic laryngitis sicca, and great swelling of the middle turbinated body, so great, indeed, that the middle meatus was completely obstructed, as well as, necessarily, the passage into the superior meatus. The case is rather one of dry rhinitis, which conducts me to the next subdivision of chronic rhinitis. But as the consideration of this involves the discussion of certain pathological points, I will postpone it to my next lecture.

CHAPTER II.

AT the close of my last lecture I referred to a case which I trust you were all able to see for yourselves, but which I regret was not as it appeared before submitting it to treatment. As I then told you, when the patient first came under observation, complaining of loss of voice and dryness in the throat, the whole of the middle meatus on both sides was blocked with a red, slightly lobulated, semi-transparent swelling. On examining it with a probe one found it to be soft and yielding, although immovable from the structure to which it was attached. But there was a further objective sign, not often found indeed, but of great importance from its diagnostic, prognostic, pathological, and therapeutic value. When I gently pushed the probe, which for such a purpose must not have a bulbous extremity, through the epithelium covering the inflammatory neoplasm and deeply into its substance, my instrument was arrested by what even a hospital dresser would unequivocally pronounce to be carious bone. We have in fact what Virchow calls an *ostitis granulosa* of the middle turbinated bone. In some cases the caries may have totally destroyed the thin bone in spots, so that the probe will pass right through it without encountering its substance; and in other cases the probe will as unmistakably reveal the presence of minute osteophytes, rather, however, on the free border than the under surface of the bone. In this case we must assume the existence of osteoplastic periostitis, which, as we know, may be met with in other situations in combination with superficial caries without suppuration.

I think it will not be amiss in this place, before proceeding further with my systematic description, to say a few words concerning the pathological anatomy of the various degrees of inflammation as it attacks the middle spongy bone and its coverings.

Let me remind you of certain anatomical facts concerning

the normal structures. The pituitary mucous membrane is highly vascular, especially toward the free margin and anterior and posterior extremities of the middle turbinated bone. It is covered with columnar ciliated epithelium, and contains, visible to the naked eye, the openings of numerous racemose glands. Its connective tissue, little elastic, is inseparably united with the subjacent periosteum, which scarcely forms a distinct structure. The bone itself is minutely and closely perforated with foramina for the passage of arterial twigs from one surface to the other, a fact of considerable importance, as will be presently seen.

Well, then, you will readily understand, when this intimate connection of mucous membrane with periosteum is considered, that there can hardly exist any degree of inflammation in the one without the other suffering. And when we also call to mind the exposed position of the structure under consideration, arresting as it does cold air laden with mechanical, biological, and chemical irritant particles, and not perpetually swept clean as is the conjunctiva by the eyelid, we can only suppose, *à priori*, that it must frequently succumb to inflammatory attacks. But however intense the inflammation of the periosteum may be, and sometimes it is sufficient to give rise to excruciating pain, it is never in ordinary attacks followed by necrosis. And why? Probably because both surfaces of this delicate bone are seldom attacked together, and the blood-vessels of the one side have as much to do with the nutrition of the other as of itself, the arterioles anastomosing through the foramina of which I have just spoken. I am speaking now of simple inflammation; in syphilitic and perhaps scrofulous inflammation both sides may be simultaneously so gravely attacked that greater or smaller portions of the bones necrose. Such pieces are either shown us by the patient, or are found lying loose in the fossæ. But as the consequence of simple persistent rhinitis, which so far as my observations go is nearly always confined to the free border and under surface, necrosis never results.

But what, then, has happened in those cases of dry atrophic rhinitis to which I shall presently refer—where there is no trace left of any middle turbinated bone at all, and which we have no reason to refer to syphilitic agency?

Simply what we should expect to happen in a case of otitis

granulosa or caries without suppuration. The pathology, indeed, is identical with that of certain cases met with in connection with the long bones, where we find a mass of granular tissue through which a probe may be pushed until it impinges on the carious bone; and this condition may obtain without the development of any pus. I believe the granulation tissue in the case of the middle turbinated bone may absorb all the bone salts and dissolve the connective tissue without producing any breach in the epithelium covering the fungous mass, or any purulent discharge or ozaena.

The minute pathological processes of chronic hyperplastic rhinitis are simple enough. The submucous connective tissue, in consequence of prolonged irritation and arterial stagnation, becomes infiltrated with small round cells, while the fibrous elements swell and lose their toughness, or are dissolved and converted into a gelatinous intercellular substance. The blood-vessels increase in size and number, while the mucous glands also probably enlarge and even become more numerous. If the inflammatory process partially subside, the inflammatory infiltration assumes a higher form of structure, and the serous infiltration disappears. The new cells partly form fibres and partly are absorbed, and we have a condition left of hyperplasia in which new tissue, similar to the old, is superadded between the layers of the latter.

But if the inflammatory process continue, the connective tissue becomes wholly replaced by this new granulation tissue. The periosteum also breaks down under its assaults, and even the connective tissue of the Haversian canals succumbs. Then follows gradually the absorption of bone salts, bone tissue, and osteoclasts by this new growth, and we have a superficial otitis granulosa; while if we thrust a probe through the mass of granulations, it impinges on carious bone. This conversion of the connective tissue of periosteum and Haversian canals into granulation tissue will ultimately cause the entire absorption of the delicate middle spongy bone, a condition which, as I have said, we do occasionally meet with; and we correctly name it atrophic rhinitis, without having any very clear idea as to its significance, or the importance of preventing its development when we discover the earlier stages of bone inflammation which lead to it.

I trust, gentlemen, you will not accuse me of being thoreti-

cal as distinguished from being practical. It has always appeared to me in the first place necessary to discover what a pathological process is before we can hope to apply remedial measures for its arrest. And the lack of accurate knowledge on this head has led some who profess to be authorities in nose disease to perpetrate the most ridiculous and unintelligible blunders in nasal therapeutics. To such errors I shall be compelled to refer in a more suitable place.

And, on the other hand, I trust you will not quarrel with me for reminding you of pathological processes with which you must be as familiar as, at least, I am. But I thought it advisable to recall to you certain inflammatory changes that occur in bone everywhere, and then to put it whether the same process must not perforce attack the middle turbinated bones of the nose, exposed as they are to sources of inflammation experienced by like tissue in no other part of the body, and whose very nature renders them highly susceptible to attack. The pathology of simple chronic inflammation in this situation is also of considerable importance as bearing on the development of mucous polypi, as we shall subsequently discover.

But now let us return to the clinical features of hypertrophic rhinitis. I have referred to the use of the probe, where we have a mass of inflammatory growth blocking the channel of the middle meatus; if it discover carious bone we must be on our guard lest the atrophic form appear; if the bone is not attacked we may be less anxious, although scarcely less energetic in our treatment.

(i.) Gradually, from a state of hyperplasia with excessive or only normal secretion, we pass into one where the mucous glands, partly from destruction by the inflammatory action, partly from former over-stimulation, strike work, and the mucous membrane is affected with dry rhinitis. Then the patient's trouble begins. For if there was a tendency to pharyngitis sicca and chronic laryngitis before, these become greatly intensified now, for the inspired air reaches the pharynx no whit the better for passing through the nose, which is dry and can neither give moisture nor abstract impurities. Then from the retention of the viscid secretion, which forms hard crusts hanging about the turbinate bodies and septum—a retention partly due to the scanty secretion, partly to the destruction of the cilia which should sweep it

backward, putrefaction sets in, and the resulting fœtor makes the patient's life wretched to himself and his presence hateful to his best friends. And it is solely for his "bad breath" very often that he seeks our aid. The ozaena must be distinguished from that due to syphilitic necrosis of the nasal bony structures. It is not possible to describe the difference in words, although it is real enough to those who are accustomed to experience both. The difference is quite intelligible when we remember that in dry rhinitis the smell is due to the crusts of muco-pus, which putrefy simply because they cannot be washed away; whereas in syphilitic affections it is due to putrefaction of pus contained in the interstices of necrosed bone. A point of some value in diagnosis is that thorough cleansing will remove the stench of dry rhinitis, while no amount of douching will destroy that of necrosed bone. So that we must not suppose every case of ozaena to be one of dry rhinitis; far from it. A certain amount is a very common termination to an ordinary attack of acute rhinitis, and is then, I believe, always more perceptible to the patient himself, during expiration, than to others. Similarly, we sometimes discover it in cases of chronic catarrhal rhinitis. In such cases it more readily succumbs to treatment than in cases of dry rhinitis. Then, again, in the matter of diagnosis we must not mistake the stench met with in a patient who has just been regaling himself with onions, cut Cavendish, and whiskey toddy! Indeed, this vicious and not uncommon combination of odors may readily be mistaken for ozaena, especially if there be at the same time any nose trouble.

If we examine the naso-pharynx, we find the same deficiency of secretion, and sometimes actual crusts. Tenacious muco-pus hangs about the vault and septum, while the lower part of the posterior wall is covered with a film of inspissated mucus, as I have already related.

To the possible causes of dry rhinitis I have already referred. Dry rhinitis is frequently accompanied by a most distressing condition of general health, though which is the primary trouble it may be difficult to say. At any rate, both the local trouble and the general symptoms react on one another; while if we can improve the one, the other is more or less benefited. Besides the symptoms referable to the throat trouble, such as aching, dysphonia, functional dysphagia, etc.,

the patient's digestion is variously disturbed. She complains of headache, drowsiness, and inability to sleep soundly. She is both nervous and hysterical; and often, though there is chronic laryngitis, the aphonia or dysphonia appears to be at least partly functional. Such symptoms are supposed by some to be of a reflex nature. If we inquire into her previous history, we find some more tangible cause than the nose trouble for her general condition. The cares of maternity, a series of unhappy love affairs, a hard task-mistress, or an inherited tendency to worry over petty annoyances; these, and such-like, will account for much of the nervous debility—an expression I employ for want of a more scientific—and anaemia from which the patients suffer. You will observe that I speak of the patient as she. We do not often see a man with dry rhinitis; but I believe most cases in males are the result very much of overwork.

Perhaps it is especially in strumous individuals that rhinitis reaches this stage. The tendency to it in some cases is apparently hereditary; at any rate we can say so of ozæna, without being more precise as to the pathological lesion. Nevertheless, there is good evidence to show that the affection is not contagious. Possibly, when several members of a family are attacked, there is a syphilitic element; or at any rate we may safely assume the existence of struma. But the whole question of etiology is a difficult one, and as I have no views of my own on the subject, I must refer you to the various textbooks.

Although I have spoken more of the general condition of adult sufferers, dry rhinitis is said to be most frequently met with in young persons between the ages of ten and twenty; that is, roughly speaking, during the period of adolescence. But I am inclined to think it is more common in persons of riper years than is usually supposed; and I think it possible that in these it is frequently overlooked, seeing that ozæna is not so common an accompaniment, and that the patients seek relief for hoarseness or dryness in the throat. I showed you at our last meeting two such cases, one, a patient of five and thirty, and the other thirty, both of whom sought relief for their aphonia. Dry rhinitis is certainly more common in women than in men. In this hospital we notice that there are nearly twice the number of female as compared with male

sufferers. I may remark here that it is frequently noticeable in young girls who menstruate regularly that the ozæna becomes intensified at the approach of their periods. There may possibly be some connection between this fact and that which makes some people assert that they know when a woman is menstruating by the odor of her breath.

The duration of dry rhinitis can hardly be stated. It persists for many years, showing no tendency to spontaneous cure. Many cases probably pass, if untreated, into the atrophic form, when the symptoms become aggravated. Nevertheless, although ozæna, a term for the most part synonymous with dry rhinitis, is generally held to be an incurable malady, yet the fact that a large majority of cases occurs in young people, whom the disease does not kill, appears to assert that they recover. Or do they give up attending us because we do them no good? Such is not the general experience with regard to other affections.

(ii.) In the atrophic form of dry rhinitis the turbinated bones may be almost or quite destroyed, while the mucous membrane when freed from its crusts has a pale shiny appearance, its submucosa being actually in a state of cirrhosis. The atrophic process may occupy many years—how many it would be difficult to say; or, on the other hand, it may be comparatively acute, as in a case which has been proceeding under my observation, and which I showed you after my last lecture. But all cases of dry rhinitis do not necessarily become atrophic; nor does the dry stage always precede the wasting.

(Although in the text only that form of atrophic rhinitis is referred to which results from inflammatory absorption of the bone tissue, one must not forget a commoner form in which no hypertrophy precedes the atrophy. It affects chiefly the inferior turbinated tissue, and occurs for the most part in anæmic constitutions. The spongy bone actually bears so small a proportion to its erectile tissue, that the observer is too ready to imagine the bone itself is atrophied when only its coverings are affected; and it is presumably in such cases that we hear of the bone tissue being regenerated [Moure]).

No mistake can possibly be made in diagnosing dry atrophic rhinitis. The roomy fossæ enable us to see the posterior wall of the naso-pharynx, and even the Eustachian orifices.

The posterior wall of the pharynx is dry, as in obstruction of the middle meatus; for although there is room enough for the inspired air to circulate in the upper part of the nasal cavities, yet the moistening function is entirely in abeyance, and hence the desiccation of the mucous membrane. We invariably find more or less chronic laryngitis, often of the dry variety.

Great quantities of greenish or blackish plugs of dried stinking mucus collect at the upper part of the spacious fossæ and are discharged only at intervals measured by the number of days, or even weeks. There is little or no disposition to use the handkerchief. Though the atrophied membrane is so little vascular, it often bleeds readily and is fairly sensitive.

And now as to the treatment of those cases of true hyperplastic rhinitis. The tendency with many practitioners is to ignore the condition if it produce no very obvious symptoms. They forget the physiological importance of the nose, and its intimate relations with other organs. Yet the treatment is simple and satisfactory; and often a tendency to pharyngitis sicca with chronic laryngitis will not be ameliorated until the passage into the superior and middle channels is freed of obstruction. I think in nasal surgery we ought to remember Carlyle's definition of dirt—"matter out of place;" and any proliferation of tissue should be looked upon as dirt and removed.

This destruction of hypertrophied mucous membrane is most readily effected with the galvano-cautery, which, however, needs some skill and discrimination in its employment. If, for instance, it is the free border of the middle turbinate body that is enlarged, I prefer, where there is a choice, to destroy the inner, rather than the outer side. And for this reason: if we destroy the under surface of the body, mucus very readily dries and accumulates there in consequence of the destruction of the mucous glands; whereas if it is the inner side which is burnt, mucus still pours down from above and keeps the cicatrized surface moist. But in cauterizing the inner side we must be very careful to apply our burner only to the diseased spot, and avoid bringing it in contact with the septum; else we may find at the patient's next visit that the septum and middle turbinated body are inseparably united, and that we have done more harm than good.

To assist the operator in avoiding so great a blunder, I

have devised a shield which can be placed and held in any spot at will, leaving both the surgeon's hands at liberty. It consists of a small ivory plate measuring half an inch or so in diameter, and attached to a flexible probe. On each inner side of an ordinary Thudichum's speculum is fixed a spring, lying close to the blade and turned a little inward at the free border. Under this spring we can readily hook the probe after the shield has been placed on the spot we desire to protect, by bending it to the suitable angle.

When the hypertrophied mucous membrane depends in a flap, we may find a hard-wire snare the most serviceable instrument for its removal. This also does good work in destroying the polypoid, cystic degeneration of the posterior extremity of the inferior turbinate body. For this purpose we must use Mackenzie's cog-wheel instrument, which, passed along the floor of the nose, can be held and tightened with the right hand while a finger of the left, thrust behind the velum, holds the loop over the swollen tissue. As I remarked in my last lecture, such a procedure often brings away nothing, although the enlargement has completely collapsed. Hypertrophied mucous membrane is often highly vascular, especially when arising from the inferior spongy body. Bleeding consequently may be rather profuse after operating; and to obviate this we must tighten our snare very slowly. For very slow work Jarvis's instrument is preferable to Mackenzie's. But as a rule I remove with the latter every abnormal structure that can be snared; failing this I employ the galvano-cautery.

In those cases where the probe, thrust through the swollen tissue filling the concavity of the middle turbinated body, impinges on carious bone, I employ a different method. The whole of the surface which appears to be diseased I scrape with a sharp spoon down to the bone itself, and dress with iodoform insufflations. There is subsequently some pain, but not very much, and the mutilated surface granulates and heals with surprising rapidity. I will show you a case presently that I have dealt with in this manner with the happiest results; we can no longer thrust a probe on to carious bone; but although the condition of dry rhinitis is much ameliorated, a cure is by no means effected, and we must trust for further improvement to our pharmacopœia. And here I must refer to an alternative method of treatment, if only for the sake of

giving it unqualified condemnation. And in order to impress this upon you, allow me to say that I have had ample opportunity of observing its results in the hands of its chief, and, as far as I know, its only advocate. I refer to the ablation of the middle turbinated bones. The operator discovers evidence of what he calls necrosing ethmoiditis (a word on this hypothetical affection may help to clear up an erroneous impression. In a large proportion of nose-patients, those initiated into the mysteries of discovering diseased bone may be misled. For if we pass a probe gently into the concavity of the middle turbinated bone, it may impinge on what every skilled hand would indubitably pronounce to be necrosed bone. But we have no suppuration, no fetor, and the symptom remains unaltered through many years; hence the probe misleads us, and we must trust to common sense in making a diagnosis. We are driven to suppose that the mucous membrane and periosteum are so attenuated in this situation that they scarcely interfere with the impact of the probe on the bone. I may remark that an ivory exostosis of the external meatus of the ear may give a very similar impression to the probe) in almost every case of hyperplasia involving the middle turbinated tissue; accordingly, though the rationale is scarcely obvious, he slips a strong cold-wire snare over the anterior extremity of the bone in question, and removes as large a portion as he can include in the noose. For my own part I believe that there is an important function in every structure of the body, notwithstanding the fact that it can be removed easily and without the consequences being fatal; and I prefer to cure the disease in question with physiological facts kept well in view.

The galvano-cautery is, as I say, generally all that is needed for simple hypertrophy of the mucous membrane. Where, however, we have a dry, glazed condition, especially if accompanied by ozæna, energetic cleansing of the parts is the first essential to a cure. For this purpose nothing is so effective as the nasal spray, for by no other means can we reach all the interstices of the ethmoid. It is best applied with the compressed-air apparatus, and both through the anterior nares and post-nasal space. If there is much accumulation of dried mucus, it may be advisable to remove it with a syringe, sniffing the solution up the nose, or with the nasal douche. The latter, however, is for many reasons objectionable.

When the cavities are fairly cleansed in this manner, it will be advisable to use the fine pneumatic spray at a pressure of about forty pounds. Simply for the rough cleansing, it is not of much consequence what fluid we employ; preferably it should contain an alkali, and some ingredient, such as chloride of sodium, which will stimulate secretion, and so the loosening of the crusts. For the final spraying probably nothing is equal to a weak solution of perchloride of mercury, say 1 in 10,000. In the hands of my colleague, Mr. T. Mark Hovell, it has been productive of the most beneficial results. Very little appears to be absorbed, and I have never seen any constitutional effects from the treatment.

Beyond cleansing and antiseptic treatment, which I say is absolutely essential, and which should be carried out if possible by the medical practitioner himself, there are two lines of treatment. First, that of stimulating the mucous glands; and secondly, that of giving them rest by protecting them from external sources of irritation.

For the former purpose we may employ insufflations of various powders. Iodoform may do good service, being at once stimulating and a most powerful antiseptic; or we may give it as a spray dissolved in ether. But the results are not very satisfactory. More encouraging is eucalyptus—one part of the powdered red gum to two of starch, as recommended by my colleague, Dr. Morell Mackenzie. Other stimulants, such as *sanguinaria canadensis* or *baptisia tinctoria*, which latter is also reputed as an antiseptic, are sometimes used. But all stimulants to the nasal secretion appear to me as faulty in principle as are hepatic stimulants to a cirrhotic liver. For whatever purpose we use stimulants, in the long run they defeat their own end. Whether operating on nerve centres, gland structures, or other tissues, stimulants draw upon capital rather than induce honest living upon interest, the natural consequences being bankruptcy. Indeed, many cases of dry rhinitis are unequivocally due to the inhalation of stimulating particles; and at least in such cases the fallacy of further stimulation is obvious enough.

So that I consider the other alternative I mentioned as preferable—namely, that of rest to the diseased structures. To effect this we must prevent the nose from performing its normal functions. And although such a proceeding would

appear to react unfavorably upon any co-existing chronic laryngitis, yet, considering the actual state of the nose, this will hardly be noticeable.

The most efficient means of giving rest to the mucous membrane is to exclude the external atmosphere with its irritating particles. We may use either respirators, which are objectionable on many counts, or plugs of cotton wool, which shall effectually block the entrance of air to the nose.

Gottstein was the first to introduce this method of treatment. His theory of its action I must state, however, is diametrically opposed to that of rest. He looks upon the plug of cotton wool as a mechanical irritant which stimulates the secretion of mucus. If it fail to moisten the surface, he assures us it is because the plug is not large enough, and not sufficiently in contact with the mucous membrane. I believe, however, that the improvement which this treatment always effects is partly due to the rest from stimulation, but largely owing to the fact that the drying up of the mucus is prevented. If a mechanical irritant were all that is needed, why do not the plugs of inspissated mucus themselves act as such? Anyhow, the treatment gives the greatest relief to the sufferers. We may enhance the beneficial effect by using medicated wools, saturated, for instance, with iodoform, camphor, boric acid, etc., according to the directions of our Pharmacopœia. But I consider it important that we should use the ordinary as distinguished from absorbent cotton wool, so as not to deprive the palate and posterior wall of the pharynx of any moisture that might flow over them.

The easiest method of introducing the pledget is by means of Gottstein's screws; they assist the efficient introduction, and can easily be withdrawn by unscrewing them from their covering. Wearing the cotton wool even for so short time as two or three hours gives great relief; but they will often be tolerated for the whole night, when the benefit is of course more striking.

II. And now I must leave the diseases which may unquestionably be placed together under the heading of chronic rhinitis, and pass on to more debatable, but not therefore less interesting, ground. I refer to those obstructions which come under my second heading, namely mucous polypi and cysts. I specify these as mucous simply to exclude malignant neo-

plasms and fibrous polypi, though I do not intend allowing the term any narrower pathological significance.

Mucous polypi are usually divided into two classes, viz., those which from their structure more resemble adenomata, and those which may be classed as myxomata. In the former, histological examination reveals chiefly large mucous glands, which here and there may be expanded into cysts, lined with columnar epithelium and bedded in retiform connective tissue with more or less of the fibrous element; while, in the latter case, they consist chiefly of embryonic mucous tissue, pellucid jelly with nucleated corpuscles, some of which branch out to form a network, while their nuclei remain at the points from which the threads radiate. In both kinds there is a layer of ciliated columnar epithelium. Afferent and efferent vessels run through the pedicle or base, which is frequently, especially in old-standing cases, strengthened by the development of bands of white fibrous tissue dispersing in the substance of the neoplasm. There are no nerves, although Billroth claims to have detected them in some cases. But, as I shall show you presently, there is no real line of demarcation between these two kinds. We might as justly employ a more extended division according as granulation, mucous, spindle-celled, or fibrous tissue predominated. But we should only be the more persuaded that the distinction was artificial, seeing that every variety has the same cause as its primary factor.

A more practical division would be into those which contain cysts and those which do not. The cyst may attain a considerable size, but it has no limiting membrane, being merely lined with columnar epithelium. For the most part those polypi situated the furthest back are the most liable to contain cysts, and rarely a large polypus blocking the post-nasal region will collapse when grasped by the forceps or noosed in the snare. Some cases of swelling of the posterior extremity of the inferior turbinated bone may belong to this class, as I have already suggested.

The mucous membrane in the neighborhood of polypi, especially when these are of some years' duration, may be fairly or even quite healthy; an important fact which may mislead us if we attempt to investigate the etiology of these commonest of all morbid growths. Often, however, the most misleading facts are of the greatest value in ascertaining the

truth—a philosophical paradox, which I hope you will pardon me for expressing.

Mucous polypi are pinkish, bluish, or sometimes greenish, semi-transparent bodies, which readily lose their water after removal, especially when cut, and become wrinkled and shrivel. They have a singular capacity for absorbing moisture even from a damp atmosphere, and hence the patient's pretty general complaint that his nose is more obstructed when the mercury falls. If after removing a polypus we immediately weigh it, and then immerse it in water for an hour or two, we shall find it has increased its weight by half as much again or more. This statement applies also to those portions of hypertrophied mucous membrane attached to the middle turbinated bone, which are so liable to degenerate into unmistakable polypi. I shall have to refer to this point again when discussing the etiology of these growths.

But to proceed with the objective characteristics of polypi.

They pit under pressure of the probe, although the depression is quickly effaced. They are more or less movable, according to the latitude of their attachment. This is sometimes a distinct fibrous pedicle, sometimes no more than a slightly constricted base, and occasionally, chiefly in recent cases, they are merely sessile. Their usual seat in those patients who seek relief is undoubtedly the free border and under surface of the middle turbinated bone, although according to Zuckerkandl's autopsies the superior meatus is the most frequent site. The growths occupy a varying space of the nasal fossæ, and may even be seen hanging into the pharynx, or protruding from the nostril. In the latter case their color may be a darker red, a shade also developed sometimes after application of the galvano-cautery, or other destructive agent. In the case of those smaller polypi which grow from the superior meatus and descend between the middle turbinated and septum, which, moreover, may easily be pushed out of sight by the probe, forcible blowing of the nose will usually bring them again within the field of vision.

When the polypi are young, and so small as to cause no subjective obstruction, we perceive on the under surface of the middle turbinated bone small reddish transparent smooth excrescences, which may readily escape notice; or if they are detected they may be considered merely as an hypertrophy of

the mucous membrane. But they are not sensitive to the probe, and, moreover, if left alone, will develop into unequivocal polypi. Nevertheless in this early stage, as far as my observations go, they are invariably associated with a chronic inflammation and hyperplasia of the mucous membrane in their immediate neighborhood.

And this brings me to the point where I must discuss the etiological pathology of the growths.

I believe that for the most part they may be regarded as oedematous inflammatory neoplasms. I have frequently watched a chronically inflamed mucous membrane slowly alter its appearance, becoming more congested and redder, then assuming a transparent oedematous aspect, gradually lose its color and rapidly develop into a typical polypus. And this in cases of both catarrhal and dry hypertrophic rhinitis, the resulting neoplasms being situated either on the free border or in the concavity of the middle turbinated bone. Indeed it appears to me that the variety of structure we find in mucous polypi depends largely upon the stage of the inflammatory process at which an oedematous change occurs. The oedema, moreover, is due in great measure or entirely to the fact that the inflammatory neoplasm is perpetually bathed in moisture, either from the contiguous mucous membrane, or from the hypertrophied mucous glands of its own structure. I will presently show you a section of hypertrophied mucous membrane, which after an hour's immersion in distilled water had increased its weight by one-half. To all appearance it consists of mucous tissue, with large spaces and fine interlacing trabeculae extending in all directions. The fibres are more inclined to be wavy than in the generality of polypi, and in this respect incline to the fibrous tissue of chronic inflammation. But in other parts of the same specimen this characteristic disappears.

Then, again, if we examine a portion of mucous membrane, the nature of which, as frequently happens, we are unable from microscopical appearances to assign definitely either to hypertrophy or polypus, we frequently find unmistakable evidence of both conditions. In some parts the tissue may be infiltrated with small round cells bedded in a fine reticulum like that of lymphoid tissue; in other situations we find spindle-cells of various sizes, their extremities lengthening into

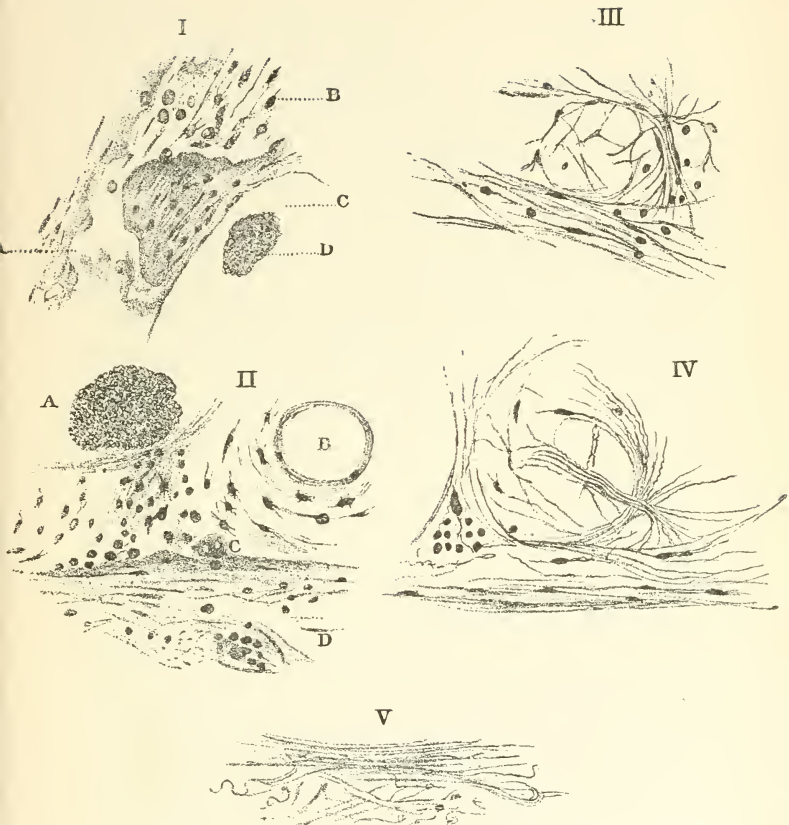


FIG. 1.—Section through hypertrophied mucous membrane, depending from middle turbinated bone. (*a*) osteophyte; (*b*) normal bone; (*c*) venous space; (*d*) blood clot.

FIG. 2.—Ditto. (*a*) blood clot in venous space; (*b*) Haversian canal; (*c*) giant cell and osteoblasts; (*d*) mucous tissue.

FIG. 3.—Ordinary mucous tissue from nasal polypus.

FIG. 4.—Edematous fibrous tissue, obtained by immersing hypertrophied mucous membrane in water.

FIG. 5.—Edematous connective tissue from elongated uvula.



fibres, which intermingle with those of mucous spaces; while immediately beneath the epithelium we find the usual layers of hypertrophical connective tissue.

In some cases polypi may be the result of metaplasia (Virchow) occurring in the hyperplastic tissue, the products of chronic inflammation. In the neighborhood of the periosteum we may find osseous metaplasia alongside of a similar mucous change. I have, under the microscope here, a section which represents this process as it takes place in a portion of hypertrophied mucous membrane detached from the free border of the middle turbinated bone, together with a few projecting osteophytes. In another portion of the same specimen one may see the bony spicule intruding between the lobules of a racemose gland, the fibrous tissue of which has undergone interstitial increase. This would fairly establish the fact that the osseous structure was a new formation, even apart from the small number of offshoots in the bone corpuscles, the numerical profusion of the latter, and other minute characteristics.

So that it appears to me that we have conclusive evidence in favor of regarding nasal polypi as inflammatory products rather than belonging to the myxomata, or adenomata, or sarcomata. And, apart from the œdematous condition, which, as I have said, is largely due to the external conditions of the growth, the likeness between a young polypus projecting from a soft, friable mass of inflamed mucous membrane and the so-called fungous granulation is remarkable. That the latter contain a quantity of well-formed mucous tissue has been pointed out by Rindfleisch, although perhaps it is more correctly likened to lymphoid tissue. But it is an accepted fact that irritated connective and other tissues not uncommonly yield mucin, which thus becomes a product of inflammation (Virchow).

Therefore I do not mean to signify that all polypi are the result of metaplasia occurring in hypertrophied mucous membrane. When it springs from a friable inflammatory swelling which consists largely of cellular elements, its growth is not unlike that of a fungous granulation. This is what I believe occurs: a small point becomes more inflamed than the surrounding tissue, rises above its level, and in consequence perhaps of its diminished support, in consequence, that is to

say, of the dissolution of its fibrous elements, absorbs the moisture in which it is bathed, and becomes pale and œdematous. Its vessels increase in size; for, instead of breaking down on the surface as would an exposed granulation, the embryonic tissue grows and becomes feebly organized, thus increasing the demand for nutrition. The granulation elements branch out or become spindle shaped, developing around the base and the blood-vessels into fibres, exactly as happens in the process of healing by granulation. The inflammatory neoplasm advances, absorbing mucus externally, pushing the mucous membrane before it, or if not this, at any rate the ciliated epithelium, until it has become a structure wholly apart from, and independent of, its parentage. The surrounding membrane from which it sprung may, indeed, protected from external irritants by its swollen offspring, return to a healthy condition; but the polypus has its own pedicle and system of vessels, and there is nothing to stop its growth. Indeed it gains strength and independence by the conversion of its root into fibrous tissue from which bands ramify into its structure.

Polypi, as I say, tend to cicatrize at their base; but the cell-growth has, so to speak, got the start, and proceeds unchecked. Indeed microscopical examination will sometimes assist prognosis, for it is found that those polypi which consist for the most part of œdematous connective tissue are much less likely to recur than those which consist mainly of spindle-shaped elements, or mucous or granulation tissue (Billroth).

All mucous polypi contain a greater or less number of mucous glands, tubular for the most part, and greatly enlarged both in calibre and the size of their epithelial linings. The proportion they bear to the mucous tissue apparently varies according to the mode of preparing the specimens. If we harden them in alcohol the mucous spaces contract, the bulk of the growth diminishes, and the relative proportion of gland-tissue increases. So that, to form a just estimate, we must make sections without any hardening. These tubular glands can readily be accounted for on the hypothesis of hypertrophy and œdematous swelling. The lobules of the racemose glands become stretched and elongated from swelling of the tissue in which they are imbedded, and thus are converted into tubular glands. And this may also explain the apparent numerical increase.

But whatever the amount of gland structure, the connective tissue of these polypi consists of granulation, mucous, spindle-celled, or œdematous fibrous tissue; and I do not see how any distinction is to be drawn between these and the myxomatous polypus.

I shall have to refer again to the etiology of neoplasms, the result of inflammatory processes, when speaking of post-nasal vegetations. Perhaps it is not of much practical importance, except in the way of preventive surgery. But the history of nasal polypi is one of the most interesting problems in pathology, and they certainly form a connecting link between inflammation and neoplasms. Doubtless, all new growth, whether inflammatory or otherwise, is the result of irritation of pre-existing elements. And, at any rate in mucous polypi, inflammatory changes lead to the formation of tissue heterologous to that from which they primarily spring.

And now, gentlemen, after so much theory you will not be sorry if I give you some practical suggestions as to treatment. And do not imagine, because we see numbers of cases in the out-patient department of the general hospital treated more or less satisfactorily, and because every general practitioner is, to a certain extent, familiar with some methods of treatment, that the special hospital has nothing to teach you. On the contrary, while polypus-patients are frequently told they have an incurable malady, we come to regard them as among the most satisfactory and easy to cure. Yet the treatment has its difficulties, principally from the fact that the mere examination of the nose needs so much practice, more even than either the larynx or the ear.

As a rule our primary object is to destroy nasal neoplasms wherever occurring. But there is one case in which we may congratulate ourselves on their appearance, and not only leave them alone, but even encourage their growth. When in a case of hypertrophic dry rhinitis a polypus appears above the level of the mucous membrane, we may expect it to have the most beneficial effect. For, as a foreign body, it stimulates secretion, and so relieves some of the most distressing of the patient's symptoms. Yet, in spite of our care, it may become dry and shrivel up. When necessary to destroy nasal polypi, as is almost invariably the case, we aim at two objects. First, the restoration of respiration through the nose, or the removal

of more remote symptoms depending on the obstruction; and secondly, the prevention of recurrence. For the former our patient is immediately and profusely grateful, while the latter he will appreciate throughout his life, especially if he has formerly been assured, as is only too frequently the case, that his malady is incurable.

There are various antiquated methods of treatment seldom now adopted, such as injecting the growths with astringents, destroying them with chemical caustics, and so on. Of such I will not speak, since I have no experience of their application. The systems to which I shall draw your attention are those of mechanical avulsion and that of the electric cautery. Among the former the forceps and the snare are the principal, and the only ones of which I shall speak.

In discussing the use of the forceps, I shall treat separately of their application to large and small polyps. In the case of the former, their advantages and disadvantages are considerable. When the polypus is very large it is impossible to know precisely what we are including in the grasp of our instrument, and I have seen the whole of the middle turbinated bone inadvertently torn away, and that by experienced hands. On the contrary, it is in these very cases that the snare is so difficult of application. Yet so uncertain is the use of the forceps, that if we bring any bone away, we say, "so much the better," whereas if we do not we may justly pride ourselves on our skilful manipulation! Sometimes it may indubitably be desirable to remove the portion of bone from which the growth springs; but in that case we ought to see exactly what we are seizing, and not to do it hap-hazard. Then again, with large polypi the rapidity of work with the forceps may be of considerable importance. And I must tell you that some of the most practised and skilful hands prefer the forceps to any other instrument for ordinary cases. The hemorrhage, however, is always more formidable with the forceps than the snare.

For small polypi, the relations and extent of which one can easily discern, I think the forceps extremely serviceable. Wide-bladed and coarsely serrated instruments are generally the best, and the simplest mechanism is all that is necessary. Occasionally slenderer instruments like those known as sinus-forceps may be extremely useful, especially for polypi situated

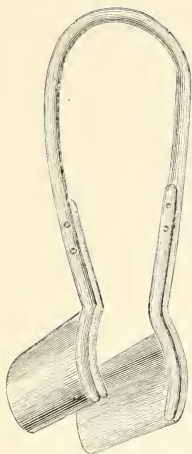


FIG. 1.



FIG. 3.



FIG. 2.

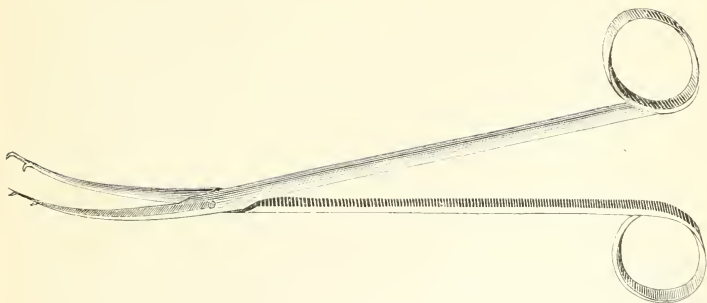


FIG. 4.

FIG. 1.—The Author's nasal speculum, with springs for holding the shields, Figs. 2 and 3.

FIG. 4.—The Author's forceps for seizing polypi in conjunction with the snare. The long diameter of the rings is transverse, in order to give the instrument a firmer grasp when held in the first and second fingers.

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far back or above the middle turbinated bone. Whenever possible we should, as all the text-books on surgery inform us, twist the polyp round and round until it breaks away. Sometimes, however, the only feasible plan is to tear them forcibly from their attachments.

There is great variety in these instruments, some of which I will hand you for examination. Perhaps no improvement has been so good as Mackenzie's punch-forceps. The handle is fixed at the proper nasal angle on the slender blades, which contain a longitudinal punch and groove respectively. Those which lock, such as Beverly Robinson's, save us a little trouble, and Mackenzie's axial forceps are useful for polypi situated high up.

Whenever possible, I prefer removing at any rate the great bulk of a polypus with the cold-wire snare, even if I finish it off with the forceps. If only for the small quantity of blood lost, the *écraseur* is far superior to the forceps. But it needs some dexterity, a good light, and a handy instrument; and, *cæteris paribus*, I consider the amount of blood lost to be in inverse ratio to the skill of the operator. There are almost as many snares as forceps; but the difference in utility is greater among the snares. The best for all practical purposes is Mackenzie's cog-wheel *écraseur*. We can wind up the wire, quickly or slowly, with the thumb, as we hold the instrument in the right hand, the left being free to alter the direction of speculum or the patient's head as required. Others, such as the many modifications of Hilton's, are available only with a soft noose, and are of no use in the denser varieties of polypus. But I find Mackenzie's instrument equally good for all kinds, while it is the only possible instrument for those cases where we must hold the noose over the polypus with our finger in the pharynx. With this instrument, too, I have removed a polypus depending from the hinder part of the superior turbinated bone, and not visible from the front, by reflecting it in the rhinoscopic mirror. Indeed, of all instruments, I consider this the most essential for nasal surgery. Jarvis's snare and its many modifications have the disadvantage of requiring two hands for their use. It was originally devised for removing hypertrophied mucous membrane from the middle turbinated bone; but even for this Mackenzie's is far superior.

Every polypus is more or less of an exceptional nature in the method of manipulation to be adopted. In the case of pedunculated polyps, our noose must be much larger necessarily than would grasp the pedicle. In tightening we must be careful not to pull upon the polyp, or we shall remove a much smaller portion than we had calculated for. Consequently, in every case, as we tighten the loop, we must advance the barrel of our instrument further into the nares. Also, as we tighten the snare, we should endeavor to lift it still higher on to the pedicle. For steadying the polypus as we do this we may grasp it, even before we throw the snare over it, with these very light forceps I have had constructed for the purpose, the forceps, of course, being thrust through the loop before seizing the tumor. In operating on growths situated very high up, or springing from the superior turbinated bone, we may find a small hook serviceable in holding the polyp in position.

Polypi which extend from the choanæ into the post-nasal space are sometimes too large to be included in any snare which can be passed through the anterior nares. In such a case the best plan is to convey a noose of soft copper-wire twist into the pharynx by means of Belloeq's canula. We then thread the ends in the barrel of a suitable instrument, such as Wilde's improved by Durham, hitch the noose over the growth with the left forefinger in the naso-pharynx, run the instrument into position in the nares, and instruct an assistant to fix the ends to the crossbar. Then we tighten the noose and bring the polypus away. Such growths, however, are frequently more fibrous than mucous. In this case, the best plan is to operate in a similar manner with a snare of platinum wire rendered incandescent, while tightening, by the electric current.

It is scarcely necessary to state that cocaine should be applied freely before any operative procedure on the nose. A ten-per-cent solution will generally suffice; but twenty per cent gives more certain results, and with actually less expenditure of the drug. A fine nasal spray producer is the most suitable method of application, as we can thrust the point behind and on all sides of the growth. Two or three minutes after applying the cocaine we may proceed to operate. In long-standing cases the mucous membrane has often become more or less anæsthetic. As a rule, no treatment is

called for after operation. Sometimes, however, after the removal of a large growth, an acute coryza supervenes in consequence of the unaccustomed exposure of the Schneiderian. Therefore in such cases, if the weather be inclement, I plug the nostril loosely with a pledget of cotton wool, which should be removed once for all when the patient reaches home.

For the prevention of recurrence there are two methods, both of which may be relied upon. The first is the galvano-cautery. If this is used so that the pedicle or base is thoroughly destroyed, our object is gained; but if used timidly and not properly localized, we may be surprised at a continual recurrence. A precautionary word in the interests of over-sensitive patients may not be amiss. There is never any occasion to let the sufferer see the incandescent point, in itself sufficiently alarming. One is frequently told of this or that operator putting red-hot wires and irons up the nose; and of this the patient naturally dreads a repetition. But, the mucous membrane well anæsthetized with cocaine, and the burner not ignited until *in situ*, the patient need not know the precise nature of the caustic we may tell him must be applied.

It is generally advisable to apply the cautery immediately after removal of the growth by the snare, else, before the patient pays a second visit, recurrence may have taken place. But we must obtain a clear view of the structure to be destroyed and all bleeding must have ceased before this is possible. Cold water is always a sufficient remedy, and we may wipe clean, with cotton wool wrapped round a probe, the region to be cauterized. One not inconsiderable advantage in using the galvano-cautery immediately is the diminished sensibility of the neighboring mucous membrane, which, however, soon regains its normal condition after removal of the obstruction.

Several operations will generally be required before the polypus is completely eradicated. And even when we think all fear of recurrence is over, we should not speak too confidently. The safest plan, both for our patient and our own reputation, is to request him to visit us again at intervals of one to six months, according to the nature of the case.

The second method of preventing recurrence is the removal of that portion of the bone from which the polypus springs. This may easily be effected if the free margin of the bone be

the site of the pedicle. Otherwise the galvano-cautery is less destructive of normal parts, and easier of application. For removing portions of bone, Mackenzie's punch-forceps, or nasal bone-forceps, may be used. Or for the anterior extremity we may employ Jarvis's or other form of *écraseur*.

When polypi are situated high up, springing from the upper surface of the middle turbinated bone, or from the superior spongy bone, it may not be possible to employ either of the methods I have advocated. But in such cases we may console ourselves by recollecting that few polypi recur more than three or four times after fairly thorough mechanical avulsion.

During the surgical treatment of nasal polypi it is preferable to suspend the use of all lotions or sprays, seeing that these but increase the tendency to rapid growth. Indeed we should aim at keeping the nasal cavities as dry as possible, and even forbid more blowing of the nose than is absolutely necessary. If much bleeding has occurred, we may keep the passages sweet with insufflations of iodoform, to which, if pain be present, a small quantity of morphia may be added.

CHAPTER III.

IN discussing post-nasal growths you will find me trespassing beyond the narrower limits of the subject even more than in those other forms of nasal obstruction to which I have drawn your attention in my previous lectures. For no form, not even that of mucous polypi, is further reaching in its effects, or has more symptoms for one or other of which our aid is sought; and at the same time for no variety of nasal obstruction is the treatment more simple in its means and satisfactory in its results, notwithstanding the fact that there is much disagreement as to the most advisable methods to be adopted.

The patient generally comes under the observation of the aural surgeon, since the affection usually escapes notice until some such serious symptoms as deafness supervenes. Yet very frequently this causes no uneasiness to the child's parents; and more especially if the family medical attendant assures them, as is only too often the case, that he will grow out of it as he waxes older. The fact that children so easily contract a little Eustachian catarrh along with acute rhinitis, from which they speedily recover, is the only reason for supposing that deafness in children diminishes as they grow older; while it is perfectly certain that the subjects of post-nasal growths, although these may after many years disappear without any treatment whatever, nevertheless seldom outgrow the deafness which results from their presence, unless operative measure be adopted.

To begin with, I will relate the subjective and objective signs of the ear-trouble. The child is deaf, and occasionally (though generally it is in older subjects) he suffers from a humming, buzzing, or hissing tinnitus, seldom pulsating, unless there be some unusual complication. Often deafness is stoutly denied; but generally, on questioning the parents, they will admit that he has been very inattentive of late, and is fre-

quently punished at school for no fault of his own. Moreover, if we examine the *membrana tympani* on each side, we shall be sure to satisfy ourselves of a necessarily faulty conduction of auditory vibrations through the drum. The most typical appearance is a greater or less degree of depression of the drum-skin. The *manubrium mallei* is foreshortened and sometimes almost invisible. Posteriorly we may possibly get a view of the long process of the *incus*, and more rarely the *processus gracilis* is seen in the anterior segment. The surrounding membrane is variously affected, according to the duration of the post-nasal obstruction; it may not be thickened, and then sometimes appears more depressed than the *manubrium*, which stands out with an abnormal prominence. The membrane is not infrequently dull in lustre; the bright spot, which in a state of health radiates from the tip of the *manubrium* downward and forward, being more or less obscured, broken, or altered in situation. Beyond thickening and opacity, the drum-skin is sometimes congested, although seldom sufficiently to give rise to pain. The one distinctive feature, however, revealed by the ear-speculum is the extreme degree of depression. I say distinctive, seeing that if we find it in a child, by that alone we may be almost sure of the presence of post-nasal growths; and hence I have described the appearances somewhat minutely.

Occasionally, though not very often, the child's chief trouble is *otorrhœa*, and we diagnose a chronic suppurative otitis with perforation of the membrane. And even in these cases, as we shall see, the post-nasal growths are still the most important factor, if we may judge by the results of treatment.

Why Eustachian obstruction should produce depression of the drum-skin may not at first sight be quite apparent. Most probably the explanation is to be found in the fact that the oxygen in the tympanum is converted into carbonic acid; and when this latter undergoes solution in the mucus, we have one-fifth of the pressure removed, one in five being the proportion of oxygen in the ordinary atmosphere. But even if no oxidizing of carbon takes place, the greater solubility of oxygen over nitrogen would fully account for the diminished pressure. The latter, seeing that the Eustachian tubes are obstructed, necessarily causes depression of the yielding wall of the cavity, viz., the *membrana tympani*.

In order of the frequency with which patients complain of the different symptoms, next comes snoring at night. This is invariably present in greater or less degree, and the child may be never free from it during sleep. It depends, I need hardly add, upon the indrawn current of air impinging upon the velum, the muscular tissue of which, if not enfeebled during the waking hours, as is frequently the case in the disease I am discussing, yet is physiologically relaxed, along with other voluntary muscles during sleep. Then if we make further inquiry we find the patient is restless, tosses about a great deal, and throws off the bedclothes, occasionally waking with mild delirium. Older patients may complain of a dryness in the throat and mouth on waking, accompanied with a general feeling of malaise, which diminishes as the day advances. The remaining direct symptoms are indistinctness of speech and inability to blow the nose satisfactorily. The disturbance in articulation is characteristic, but is similar to that found in the other forms of complete nasal obstruction. We are told that the patient speaks as though he always had a cold in his head. He unavoidably substitutes B for P, one of the important differences between these labials being that P is assisted by resonance in the nasal cavities. If with the post-nasal space completely occluded we try ever so energetically to say P, we can emit nothing more than an intensified B. Correspondingly D takes the place of T, and DH of TH. Similarly, seeing that M and N depend entirely upon nasal expiration, when this is impossible, we are forced to say bay for may, and day for nay.

But besides these changes of labials and dentals dependent upon nasal obstruction, we may have other faults in articulation, due to inability of the palate to approximate itself to the posterior wall of the pharynx, either on account of the mechanical interference of the growths, or simply from paresis of the palate due to the co-existent congestion of the palatine glands and muscular tissue. The gutturals in these cases lose some of their value, and we find G substituted for K, and kick becomes gick. This weakness in the pronunciation of the gutturals is frequently found with a feebly-acting palate, where there is no obstruction, and the only other objective sign is a post-nasal catarrh, or vascular tumefaction of the inferior turbinate bodies; so that from a person's speech alone we may

often diagnose a catarrhal condition. In extreme degrees of enfeebled palate the impairment of speech closely resembles that occurring in cleft-palate patients. Thus D may approximate to N, and B to M. Even G, hard, may be almost an impossibility; while S and CH are also difficult. But beyond such palpable deficiencies, there is more that cannot be easily described. The speech is thick, difficult of comprehension, nearly all consonants being more or less blunted, and nasal. In such cases the patient really speaks through his nose. Possibly enough the so-called Yankee twang is due to an enfeebled palate; and it is by no means unlikely that this is more frequent across the Atlantic, when we remember the prevalence there of post-nasal catarrh.

There are a few other and less important subjective signs. There may be accumulation of mucus at the back of the throat, a reflex cough from the irritation produced, or frequent hawking from the sensation of a foreign body in the throat which cannot be dislodged. Then there may be a watery discharge from the nostrils, and even a little excoriation may be produced.

Finally, there is always more or less general disturbance of nutrition. The child is anæmic. He is stupid to a degree greater than can be accounted for by the often very slight deafness. He is peevish, reluctant to play, and disinclined for exercise. He takes cold in his chest, as we are told, on the slightest provocation; eats capriciously, and his bowels may be very irregular.

We now come to the objective signs, which, taken even separately and apart from special examination, are highly characteristic. To the physiognomical aspect of these patients I have referred in a former lecture. Let me recapitulate the points briefly. The buccal respiration attracts the attention of the most casual observer. It does not consist merely in elevation of the upper lip as occurs in swelling of the middle turbinated tissue; but the lower jaw hangs away from the upper to a greater or less degree, while the lips are prominent and expressionless from enfeeblement, through partial abolition of function of the orbicularis oris. Then when we have a good light thrown squarely on the child's face we see a little depression on each ala of the nose, situated at the angle between the superior and inferior lateral cartilages. This ap-

parently insignificant sign I consider quite pathognomonic either of the present or former existence of post-nasal growths. At any rate we do not see it in other cases of nasal obstruction. But besides this dimple, we observe with it that the nostrils are unusually narrow, while the bridge of the nose appears correspondingly widened. The collapse of the alæ and the dimples are due to the same cause. From inability to use the nose we must assume that the dilators of the nostrils are functionally in abeyance, and the alæ therefore collapsed; and this granted, we should assume that the portion least supported by the cartilages falls in the most. This portion is the angle between the superior and inferior lateral cartilages to which I have just referred, and which is filled in merely with a little connective tissue. Hence it collapses and forms a dimple.

I have heard this depression and the slit-like nostrils referred to as a symptom of enlarged tonsils; but, as I shall presently point out, enlarged tonsils frequently accompany post-nasal growths; and although tonsils may be so swollen as to interfere seriously with buccal respiration, I hardly think they can encroach upon the post-nasal space any more than upon the Eustachian tubes as they were formerly supposed to do. So until I see a case of enlarged tonsils without even the remains of post-nasal growths, I shall believe the signs I speak of to be pathognomonic of post-nasal obstruction. In confirmation of this hypothesis I may point out that even in double tonsillitis, where the tonsils may be more swollen than ever occurs from chronic enlargement, the patient almost invariably adopts nasal respiration.

While still on the topic of the nose I must inform you that in a large number of patients suffering from post-nasal growths, the cavities of the nasal fossæ appear small and ill-developed; while in fewer cases the hard palate is highly arched and narrowed anteriorly. And this condition we may find in adults where little else remains to tell of the former obstruction; for, as I shall presently point out, these growths generally undergo more or less atrophy at puberty, just as is the case with enlarged tonsils; but only after much mischief, now irremediable, has resulted from their presence. This ill-development of the nasal cavities may be to a certain extent aggravated in consequence of their posterior obstruction and

disuse, and is no more than one would expect on physiological grounds. The form of superior maxilla to which I refer is commonly described by dental surgeons as V-shaped. The contraction is sometimes excessively pronounced opposite the bicusps; and the more pronounced it is, the higher is the vault and the greater the encroachment on the nasal cavities. Sir John Tomes says that this form of superior maxilla is frequently seen in children with enlarged tonsils, which, I repeat, frequently accompany post-nasal growths. He remarks, moreover, on the buccal respiration, but probably was not familiar with the vegetations. He attributes the narrowing of the superior maxilla to undue pressure of the buccinator on the alveoli consequent on the depressed lower jaw. But although the fact he notices is of extreme value, we need not accept his somewhat far-fetched explanation of it. Of these points I shall have more to say when I discuss the etiology and pathology. ("A System of Dental Surgery," by Sir J. Tomes; 2d edition. In the 3d edition, 1887, the author's remarks are considerably curtailed.)

The next step in the examination of the patient is to inspect the pharynx. Here again the appearances are often quite distinctive. Very frequently, but by no means in the majority of subjects, we find the tonsils enlarged. Sometimes they are enormous, and meet in the middle line; and then we may defer the verification of our diagnosis until they have been treated by operation or otherwise. But it is especially when the tonsils are normal, or nearly so, that the pharyngeal appearances are so characteristic. The mucous membrane of the palate and posterior wall is often almost œdematous in appearance, although the color is heightened rather than otherwise; that is to say, there is a semi-transparent and very watery aspect of the structures. This is seen especially well in the uvula, which may be rather elongated and twisted to one side—due, I imagine, to a commencing paresis of the muscular structure on the opposite side. The palate, as I have already remarked in discussing the abnormalities of articulation, may be thoroughly paretic, refusing altogether to respond to tactile stimulation. But when we have the paretic palate, the œdematous juicy appearance of it, if I may so speak, is not so marked and it is only in long-standing and generally anæmic cases that an extreme degree of muscular weakness is reached.

On the posterior wall of the pharynx we invariably see more or less mucus running down from the post-nasal region. Sometimes it is quite puriform, while at others it consists solely of thick tenacious mucus. Occasionally we have to wash it away with a douche or brush before we can inspect the subjacent mucous membrane. This is always more or less granular. But the granulations share the general surrounding aspect. They look watery and œdematous, as compared with the granulations seen in common granular pharyngitis, and frequently appear paler than the membrane from which they spring. In this case they may attain a considerable size, increasing in the upper parts until they disappear behind the velum and become continuous with the masses of lymphoid tissue which crowd the post-nasal space. When the connection is so obvious as this, and the granulations of the pharynx are almost in direct continuity with the post-nasal growths, we can hardly have any doubt as to their pathological anatomy, and we are inevitably led to suspect that the granulations of granular pharyngitis are pathologically if not etiologically identical with post-nasal growths. Sometimes we find sessile or pendulous growths attached to the uvula. I have seen them over an inch and a half long—long enough, in fact, to pass into the œsophagus during deglutition, and thus fortunately to avoid the laryngeal cavity.

Rarely one discovers a pharyngitis sicca, which in the absence of middle turbinated swelling or rhinitis sicca, is apt to confuse the diagnosis. But in such cases we find the growths confined to the upper part of the naso-pharynx, obstructing, in fact, the superior and middle meatus. Respiration is not buccal, but is carried on through the inferior meatus solely, which, as I pointed out in my first lecture, is generally the cause of the mucus-desiccation.

We now pass on to ocular and digital examination of the neoplasms themselves.

In recent cases in young children it is impossible to use the post-rhinal mirror, partly because of the insubordination of the patient, but even more on account of the irritability and contractility of the soft palate. But in cases of long duration, where the velum is anæmic, pendulous, and not responding to tactile stimulation, we may complete our diagnosis with the mirror. The image has a very varying appearance, but what-

ever the aspect of the individual growths, we see the post-nasal region more or less filled up. When the obstruction is not large, and especially when the surface is smooth and uniform, it may easily escape detection; but, by directing attention to the outline of the summit of the choanae, if we see this hidden, we may conclude on the presence of neoplasms. Frequently, however, we see the posterior wall, the vault, and the parts surrounding the Eustachian tubes, studded with excrescences varying in size from that of the conventional hemp-seed to the magnitude of a cob-nut or more. Occasionally they hang down in clusters, currant-like, from the vault and posterior wall. And in old-standing cases we may see a uniform mass rising from the posterior wall, overlapping the Eustachian tubes, and extending almost into the posterior nares and downward so as to force the soft palate into a perpendicular situation. When the growth consists of individual lobules, we may see them readily through one of Zaufal's long nasal specula. But although this surgeon operates through his instrument, its employment is painful and quite unnecessary for diagnosis. The growths are generally pale in color, smooth, and moist on their surface. But the color is sometimes as dark as that of the pharyngeal mucous membrane.

Whenever, for the reasons I have stated, the post-rhinal mirror cannot be employed, we may confirm our diagnosis with the finger thrust upward behind the soft palate. This, like all manipulations in the throat, must be at once bold and gentle, while we must irritate the pharyngeal wall as little as possible. Digital examination is not always as easy a matter as it appears, so closely may the velum be applied to the posterior wall. When there is any difficulty it can always be surmounted by putting the fore-finger, the palm of the hand looking necessarily upward, behind the posterior pillar, a little above the tonsil, and sweeping it upward. The finger then discovers a soft, yielding mass, seldom distinguishable as separate growths, but giving a very similar sensation to that afforded by a varicocele. The obstruction is never so great but that we can reach the septum, which, by the way, is rarely or never involved in the morbid process. We can also feel the orifices of the Eustachian tubes. It is the posterior wall and vault especially that are covered with the soft, yielding neoplasms. Sometimes the finger can detect no more than

that the mucous membrane feels velvety and thickened; while in other cases, where, from other objective signs, we should expect to find a considerable mass of growths, we find only a few comparatively hard excrescences about the upper part of the posterior wall. This latter condition occurs for the most part in adults, in whom previously voluminous growths have undergone atrophy as puberty advanced. But taking all cases, the consistence of the neoplasms varies greatly. When we withdraw our finger we are certain to find it streaked with blood—a contingency seldom occurring when the post-nasal region is free of these vegetations.

In every case of the disease we should not omit an examination of the larynx and thorax. In the former we generally discover more or less chronic congestion and even thickening of the mucous membrane, while in the thorax we may discover various degrees of pigeon-breast, evidence of the obstruction to respiration.

And now as to the diagnosis. There are very few affections for which post-nasal growths can be mistaken, and practically errors need never occur. The age of the patient generally precludes the possibility of fibrous naso-pharyngeal polypi. The latter scarcely ever occur before puberty; while the same remark applies to mucous polypi occupying the posterior parts of the choanæ. The fibrous polypus is hard and resistant, bleeding readily, purple or red in color. There is frequent and severe epistaxis, distortion of neighboring parts, etc., so that a mistake can hardly arise.

Anterior rhinoscopy will eliminate other sources of nasal obstruction. Retro-pharyngeal abscess, when occurring insidiously in infants, may be mistaken for post-nasal vegetations. But the dysphagia, the rigid neck, with retraction of the head, and the nocturnal elevation of temperature, accompanied by a fluctuating swelling in the back of the pharynx, ought to establish the diagnosis without much difficulty.

The duration of post-nasal growths cannot be definitely stated. Probably most cases advance or remain stationary until the fifteenth year or so, when, as is generally conceded, they atrophy, or lose their importance from the widening of the cavity in which they are placed. We must, however, never look forward to this atrophy as the *vis medicatrix naturæ*, since long before it occurs, much permanent mischief may result from their presence.

The etiology of this affection is extremely obscure, and has given rise to much discussion. In the first place, as you will have already gathered, it is an affection almost confined to children, although very rarely we may find the growths developing in after-life, and even after the fortieth year. The two sexes appear to be equally affected. No special diathesis, as far as my observation goes, can be charged with their genesis; although, seeing that many cases appear to result from chronic nasal catarrh, struma may indirectly have some influence. There are, however, certain associated conditions which throw some light on possible causes. I have mentioned the frequent co-existence of enlarged tonsils, and the badly-developed nasal cavities. And along with these, we sometimes find a narrow or typically V-shaped hard palate, with dental irregularities in the superior maxilla; while, in a large proportion of all cases of cleft-palate, we find the post-nasal region more or less crowded with vegetations.

So that we cannot, I think, infer that inflammatory action is always the cause of post-nasal growths. But before I can discuss further their etiology, I must make you acquainted with their pathological anatomy.

Speaking concisely, we say that the post-nasal growths consist of lymphoid tissue, and are nearly identical in structure with the tonsils. This lymphoid tissue is frequently called adenoid, after the nomenclature of His; but seeing that we have no authority whatever for assuming the tonsils or other accumulations of this tissue to have a glandular structure or function, the term is somewhat inappropriate. But anyhow, if we do prefer to speak of adenoid post-nasal growths, we must remember they are in no sense glands. This tissue, I need scarcely remind you, consists of a retiform connective tissue, the trabeculae of which are formed of ramified corpuscles, which may or may not retain their nuclei. The network is more or less stuffed with lymph-corpuscles. Remembering that physiologists are unable to assign any definite function to this tissue, and that we find it, one may almost say, scattered everywhere; forming the sustentacular tissue of the blood-vessels and the network within the lymphatic glands; composing the solitary and agminated glands of the intestine, the tongue, and the tonsils; constituting the thymus gland and the spleen; situated in the intestinal mucous membrane,

and forming a distinct layer in the mucous membrane of the pharynx and naso-pharynx, in which situations it is gathered up here and there into distinct structures, especially in the region known as Luschka's tonsil, and in a band running round the posterior wall on a level with the margin of the superior constrictor; remembering, I say, the evident importance of the tissue, although we cannot discover what purpose it fulfils in physiology, we cannot but be in doubt as to its significance when it appears as a pathological product. Is it inflammatory in its origin? Is it strictly a neoplasm? Or is it still physiological? Such and similar questions naturally suggest themselves, and would be of considerable importance in the treatment of the sufferers if we could answer them truly. Are we, for instance, to operate whenever we discover post-nasal growths, independently of any interference or not which they may cause?

Although I do not pretend to answer physiological questions, I shall nevertheless venture to suggest an explanation of the special forms of lymphoid growths which we are discussing.

I must, however, diverge for one moment to show you how I regard the tonsillar structure and its hypertrophy, in order to warn you of what I cannot but consider a real danger. There is a strong tendency to regard the tonsils as physiologically unimportant. This view is partly maintained, I imagine, by the unfortunate facility with which the structures can be amputated, and our consequent self-gratulation on having done something. But when we remember the enormously rich blood supply of these organs, I think we must allow them an important part in the economy, although we may not have the least idea as to its nature. Blood cannot flow through any structure without either causing growth of that organ or being used by it for some work—unless, indeed, the tonsillar veins, etc., contain arterial blood—a supposition too ridiculous! And since the tonsils remain stationary in size, we know from physiological laws that they must perform considerable work. Therefore do not let us remove them unless their hypertrophy is causing real mischief and cannot be subdued by medicinal measures.

And since it is more than highly probable that the lymphoid tissue of the tonsils performs definite work, so must we

assume the same tissue elsewhere to possess its functions. Nor shall we be going too far in assuming that the collections of lymphoid tissue known as Luschka's tonsil, and others scattered over the naso-pharyngeal surface, are physiological.

But, as I just now casually remarked, if nutriment to the tissues is put to no other uses, it will augment the bulk of those tissues. In many organs of the body a special structure is provided for the absorption of superfluous nutriment, in what is known as adipose tissue. Only second to this, as it appears to me, in capacity for assimilating nutriment is the lymphoid tissue. Indeed the condition commonly described as hypertrophic pharyngitis, where the velum, the uvula, and the pharyngeal walls are uniformly thickened, is simply an hypertrophy of the lymphoid tissue existing in the deeper layers of the mucous membrane, and occurs almost invariably, as far as my observations have gone, in plethoric or overfed individuals. In my own mind it is quite certain that just as fat is deposited in the subcutaneous tissue, so does this lymphoid structure hypertrophy in the submucous tissue, at any rate in the case of adults.

But these remarks obviously do not apply to special collections of the tissue, such as the tonsils and those on the posterior naso-pharyngeal wall. Enlargement of these does not accompany systemic hypernutrition. Before puberty, however, these collections of lymphoid tissue apparently have a great tendency to hypertrophy under slight or imperceptible stimulation. The irritation leading to increased blood supply may be only local, as in enlarged tonsils and post-nasal growths. In subacute, running into chronic tonsillitis, where there can be no doubt as to the inflammatory condition of the mucous membrane, we may get permanent increase of the lymphoid tissue, and enlargement of the organ. And I imagine that it is either to some similar conditions that we must look for an explanation of the presence of post-nasal growths, or else to some other cause of local repletion.

In the first case, it is highly probable that a chronic inflammatory condition of the nasal mucous membrane is the cause of the hypernutrition in the lymphoid tissue of Luschka's tonsil and that of the posterior wall. Thus it is especially in cold damp climates that these growths have been detected. In Denmark—Meyer, of Copenhagen, being the first

to draw due attention to their importance—they appear to be very common. In the north of Germany, in Great Britain, and in France they must be nearly as prevalent. And it is just in such climates that acute and chronic rhinitis is most common in children. In America, where the atmosphere is peculiarly dry, the post-nasal growths are much less common; and here, although in adults post-nasal catarrh is almost the rule, there is less liability to take cold from simple exposure to the weather. As with ordinary catarrhs, so post-nasal growths run in families; but I have seen no evidence of hereditary influence as is claimed by Meyer and Löwenberg. Nevertheless, dental surgeons acknowledge distinct heredity in the matter of the V-shaped superior maxilla; and from the frequent associations of this with post-nasal growths, we may so far assume the influence of heredity in the latter. So that, considering these various facts, I think we may safely infer that nasal catarrh is an important element in the production of post-nasal growths. But many of such cases, I suspect, are assisted by other means through which local hypernutrition is established. To these I will now refer.

The frequency with which the post-nasal region is found crowded with lymphoid growths in cases of congenital cleft-palate, points to some other cause than nasal and post-nasal catarrh. It has been supposed that the food passes into the post-nasal region during deglutition, and so sets up a chronic inflammatory condition. But as a matter of fact, this is very rarely a source of complaint in cleft-palate patients. Owing to the sphincter-like contraction of the superior constrictor, referred to by Billroth, and often observed by myself both in these patients and by means of anterior rhinoscopy in ordinary cases, the posterior wall of the pharynx comes almost into apposition with the margin of the hard-palate, while the tonsils by the same agency are approximated; and it is by these means that the deficiency is effectually closed. So the theory of direct irritation is insufficient. According to Dr. N. W. Kingsley, of New York, the principal living authority on the subject of oral deformities, congenital cleft-palate is usually accompanied by more or less deformity of the sides of the alveolar arch. ("A Treatise on Oral Deformities," etc., English ed., 1881.) Sometimes they are abnormally far apart; but more frequently they are found pinched together. This

must correspond, as in cases of the V-shaped superior maxilla, with contracted nasal fossæ; and thus far the condition is similar. And it appears to me probable that for all cases where this contraction obtains, we have a very simple explanation of post-nasal growths. But to make this causation plain, you must pardon me if I refer once more to the physiology of the nose. The principal function of this organ appears to be warming of the inspired air; that is to say, the tissues are constantly giving up heat. Now we know that the generation of caloric implies work-potential as much as the secretion of bile, mind-energy or any other physiological phenomenon. That is to say, oxygenation of tissue must be carried on at a peculiarly high rate in the nose and post-nasal region. (According to Aschenbrandt's experiments, by the nasal cavities alone the inspired air is raised to the temperature of the body. "Ueber die Bedeutung der Nase in Respiration," Würzburg, 1886.) Now, if the post-nasal space is deprived of the cold air necessary to the performance of its functions, whether from congenital malformation as in cleft-palate, or from nasal obstruction caused by narrowing of the nasal fossæ in combination with chronic rhinitis; if also the tissues are themselves in a state of inflammation, and so their duties seriously interfered with; we must assume that the rich blood supply will be converted to other uses, and over-nourish that lymphoid tissue which in young people, and wherever situated, is so ready to assimilate property to which it is not strictly entitled.

That the post-nasal region has an important share in calorification, we may presume from the fact that, owing to the direction of the epiglottis backward during ordinary respiration, the inspired air is swept over the posterior wall. I may suggest, by the way, that this position of the valve has something to do with the difficulty attending buccal respiration.

Moreover, in cases of cleft-palate, apart from the usual accompanying contraction of the nasal cavities, the inspired air must enter the buccal cavity before it reaches the posterior naso-pharyngeal wall. Consequently the latter is prevented, partly for this reason, from performing its functions.

I hope, gentlemen, you will not think I am drawing conclusions from insufficient premises. I do not think, myself, I am trespassing beyond the rules of scientific deduction. We

have certain facts known concerning a given phenomenon; our reason tells us that there must be one or more causes both of the phenomenon and its various attributes; and by questioning how the individual points may be produced, we should arrive at the real nature of the phenomenon. In the present case we are given the facts of persistent nasal obstruction, either from congenital malformation, or from chronic rhinitis, or both. We are also given the fact that the tissue of which post-nasal neoplasms consists is everywhere prone to over assimilation; and we are given the fact that interruption in the performance of work must lead to hypernutrition. These are our data: and we can hardly be considered unscientific in considering them related to one another in the manner I have indicated.

The treatment of post-nasal growths need not detain us long. In the first place you should not remove them simply because your finger may detect a few; and unless there is marked buccal respiration with its accompaniments, they may be left alone and allowed the honor of physiological respect. But this rule has one reservation. If the hearing is affected—and for this we must not take the word of even enlightened patients, but rest solely on the aural speculum—if the hearing is faulty, I say, and we can detect any post-nasal growths, we should always remove them, even if they are causing no Eustachian obstruction.

Even where we have a perforation of the membrana tympani with a suppurative otitis, we may expect the most remarkable results from removal of the growths—even though they are too few to produce any direct symptoms. Such cases, together with a fact I have repeatedly observed, viz., that the improvement in hearing is less marked when we remove the growths by several operations than when a complete clearance is made at one sitting, make me believe that the advantages of the operation are largely due to a counter-irritant action. Another argument in favor of a single operation is the recurrence of the growths if they are not completely eradicated. I have seen several instances of this; and although the view is not generally held, Meyer has remarked on the fact.

The instrument I always employ is a modification of Löwenberg's forceps. The precision, rapidity, and accuracy with

which these can be used, has made me reluctant to employ other instruments. The cutting-edge should be confined to the posterior and upper surfaces of the spoon-shaped extremities, else there is some danger, especially when no anæsthetic is used and the finger cannot guide the instrument, of gripping the mucous membrane on the posterior surface of the soft palate. Whenever possible, chloroform should be administered, and this in preference to ether, as the latter produces congestion of the mucous membrane, and so increases the hemorrhage. The shoulders should be slightly raised, with the head inclining backward, in order that the blood may flow from the nostrils rather than into the pharynx. Then, with the forefinger of the left hand as a guide in the post-nasal space, we thrust the forceps behind the velum, and remove the growth piece by piece. When at all resistant, they should be twisted as much as possible before being torn off. Working in this manner we can rapidly remove every particle, and run no risk of doing mischief. In order to emphasize the sort of trouble that may arise from careless operating, let me tell you that, in one of my earliest operations, I removed inadvertently a splinter from the vomer; and in another case where I allowed a clinical clerk to operate, I found to my dismay that he had stripped the whole of the posterior wall of mucous membrane! But by feeling every portion with the finger before removing it, we obviate all such dangers. When operating at several sittings without an anæsthetic, we cannot use the finger in this manner, and must trust to our sense of touch transferred to the cutting-edge of our forceps, while making, at frequent intervals, digital examinations.

The hemorrhage is sometimes rather profuse, but seldom sufficiently so to necessitate the exhibition of styptics. I have never heard or read of a case of alarming hemorrhage.

The after-treatment is of some little importance. The temperature usually rises slightly for a day or two, and sore throat is complained of. But forty-eight hours in bed, with slop food, are all that is required in the way of treatment. From that time the patient's health begins to improve rapidly in every way. His hearing distance is, in nine cases out of ten, immediately increased, and often to an extraordinary degree. The snoring also disappears, but the buccal respiration and the faulty articulation take longer to overcome. The

patient needs careful education in speech and respiration if he is to surmount the long-enforced evil habits. And we must remember that chronic catarrh with hypertrophy of the mucous membrane, deflected septum, and general narrowing of the nasal fossæ, not only are often the causes of the post-nasal growths, but in themselves may be sufficient to produce buccal respiration. Therefore these points demand as much attention as the main trouble.

But there is one point upon which I must lay great stress, namely, the careful inspection of the membrana tympani for three or four days after the operation. Rarely, and even while the hearing is notably improved by the operation, we may find subsequently a slight suppurative otitis. Perhaps no pain is complained of in the ear, and the only indication of the mischief is a small perforation of the drum-skin. In the very few cases I have seen of this accident, no harm has resulted. The perforation readily healed, almost as though it were traumatic, and left no trace of its existence. I do not think that any blame is to be attributed the operator when this occurs and I do not consider it in any sense an argument in disparagement of the operation. Why it should occur I do not know; it may possibly belong to the little understood domain of counter-irritation. It is more probable, however, that the first opening of the Eustachian tube admits blood as well as air. This putrefying would indubitably excite a suppurative otitis. Not a few cases are on record where epistaxis has been followed by otitis, probably due to similar causes. I have seen one such myself, and can recall a very severe case of otitis following the removal of a polypus springing from the middle turbinated bone.

Various other methods are employed for the eradication of these growths, from the finger-nail to the cold snare applied through Zaufal's funnel. But to my mind nothing is so precise, speedy, and I may say miraculously beneficial, as the forceps. How a curette can avoid injuring the mucous membrane along with the neoplasms, I cannot see; nor can I believe in the removal of such dense structures, as one sometimes finds, with the finger-nail. But it is only fair to tell you that one of the most celebrated aurists in London affirms that if he finds post-nasal growths on digital examination, he removes, then and there, without introducing his finger a second

time, as many of the vegetations as he considers necessary—which I venture to think is not many. For my own part, whenever I have attempted removal by the finger-nail, which I must confess has not been often, I have found the improvement in hearing but slight, while sometimes a rapid recurrence of the growths has taken place.

I think it is generally advantageous to apply, a few days after the operation, some form of astringent to the post-nasal region. We may use a diluted glycerin of tannin, or a solution of perchloride of iron, applying it with a camel's-hair brush behind the soft-palate on alternate days, or even daily, as soon as all pain on swallowing has passed away. And besides this, it will generally be necessary to keep the passages of the nose and vault of the naso-pharynx clean with antiseptic sprays, such as the *lotio alkalina*, to which I have referred so often.

The paretic palate is as difficult to treat as the buccal respiration; but, at any rate in young and intelligent persons, we can hope for much improvement in the speech. Education in elocution gives the best results, seeing that the faulty habits in word-production must be eradicated. I always recommend my patients to accustom themselves to gargling with cold water on every opportunity, and, if they sing, to use head and falsetto notes as much as possible. By these means the levators of the palate and the superior constrictor are thrown into action. In long-standing cases I have had good results from applying faradism to the muscles at fault. But the process is tedious, and few possess the necessary patience for its satisfactory employment.

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FORMULÆ.

Nebula alkalina :

℞ Sodæ bicarbonatis,	gr. xv.
Boracis,	gr. xv.
Acidi carbolici,	gr. iv.
Glycerini,	. . . . .	℥ xlv.
Aquæ fontis,	. . . . .	ad ʒ i.

Used as a nasal spray or for insufflation diluted with two parts of warm water.

℞ Tincturæ sanguinariæ Canadensis,	ʒ i. ad ʒ ij.
Aquæ,	. . . . . ad ʒ i.

As a stimulating nasal spray.

Insufflations:

℞ Pulv. gummi rubri,	. . . . .	p. i.
Pulv. amyli,	. . . . .	ps. ij.

For use as a nasal stimulant and antiseptic

Iodoform,	
Pulv. Amyli,	. . . . . āā partes æquales.

As a powerful antiseptic in ozæna. Iodol may be substituted when the smell of iodoform is badly tolerated.





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